The case for transition to a sustainable transport system in Stellenbosch

by
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Thesis presented in partial fulfilment of the requirements for the degree of Master of Philosophy in Sustainable Development Planning and Management at the University of Stellenbosch

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March 2012

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Abstract

Human existence in its current form is unsustainable. Urban transport systems are one of the chief contributors to this problem due to the dominant role of the car. Car dominated transport systems have a number of serious impacts on social, economic and ecological systems which collectively suggest they are not sustainable. The complex, global "system of automobility", a powerful socio-technical regime, ensures that car dominated transport systems endure, despite the serious problems they generate.

In the face of the power and resilience of this system, there are examples around the world of urban areas which have implemented transport initiatives which depart from the dominant paradigm of automobility. They have successfully provided viable alternatives to the car, facilitated urban forms which are supportive of green modes and "reconquered" scarce urban space from the automobile.

However, there are a multitude of barriers to any transition to sustainable urban transport systems. These can only be overcome through the related processes of contestation and innovation.

The case of Stellenbosch is a local expression of the global "system of automobility". Through a combination of infrastructure, urban form, institutions, beliefs and ways of life, this system is perpetuated at a local level. In a highly inequitable developing country context, this is particularly problematic. A town primarily designed to service car mobility is best suited to the reproduction of the middle class. The poor, and others without access to a car, are at a disadvantage and movement by green modes is, everywhere, discouraged.

And yet, there are a number of innovative initiatives occurring within the town which depart from the dominant paradigm, contesting its continued dominance. The path towards transition is at all times uncertain. However, it is possible to enhance the potential for transition by strengthening existing niches, contesting existing regimes and preparing for the imminent increase in landscape pressure generated by climate change and resource scarcity.

Opsomming

Menslike bestaan in sy huidige vorm is onvolhoubaar. Stedelike vervoerstelsels is een van die belangrikste bydraers tot hierdie probleem weens die oorheersende rol van die motor. Vervoerstelsels waar die motor die botoon voer het ‘n aantal ernstige gevolge op maatskaplike, ekonomiese en ekologiese stelsels wat gesamentlik daarop dui dat sodanige stelsels nie volhoubaar is nie. Die komplekse, globale “stelsel van motorvervoer”, ‘n kragtige sosio-tegniese regime, verseker dat vervoerstelsels waar die motor die botoon voer in stand gehou word, ondanks die ernstige probleme wat hulle skep.

Met inagneming van die krag en veerkragtigheid van hierdie stelsel bestaan daar oral in die wêreld voorbeelde van stedelike gebiede wat vervoerinisiatiewe geïmplementeer het wat afwyk van die oorheersende paradigma van motorvervoer. Hulle het uitvoerbare alternatiewe vir die motor suksesvol verskaf, stedelike vorme wat groen gebruike ondersteun gefasiliteer en skaars stedelike ruimte van die motorvoertuig “herwin”.

Daar is egter ‘n menigte hindernisse in die pad van enige oorgang tot volhoubare stedelike vervoerstelsels. Dit kan slegs oorkom word deur die verwante prosesse van verset en innovering.

Die geval van Stellenbosch is ‘n plaaslike uitdrukking van die globale “stelsel van motorvervoer”. Deur ‘n kombinasie van infrastruktuur, stedelike vorm, instellings, gebruike en lewenswyses word hierdie stelsel op ‘n plaaslike vlak bestendig en behou. Teen die agtergrond van ’n uiters onregverdig ontwikkelende land is dit in die besonder problematies. ‘n Dorp wat in die eerste plek uitgelê is om vervoer wat op motors berus, te bedien, is veral geskik vir die reproduksie van die middelklas. Die armes en diegene sonder toegang tot ‘n motor word benadeel en beweging met behulp van groen wyses word oral ontmoedig.

En tog kom daar ‘n aantal vernuwende inisiatiewe in die dorp voor wat afwyk van die oorheersende paradigma wat die voortgesette oorheersing daarvan beveg. Die weg na oorgang is te alle tye onseker. Dit is egter moontlik om die potensiaal vir oorgang te verbeter deur versterking van bestaande nisse, bestryding van bestaande regimes en voorbereiding vir die toenemende druk op die landskap weens klimaatsverandering en die skaarste aan hulpbronne.

Acknowledgements

First, I would like to thank the *Centre for Renewable and Sustainable Energy Studies* at Stellenbosch University. Their generous financial assistance allowed me to pursue my studies.

Secondly, I would like to thank my supervisor, Prof. Mark Swilling, who has ably guided me through the research process.

And finally, I would like to thank those who participated in this research as interviewees and contributors. Without them I would not have been able to able to gain the thorough understanding that I now have. In particular I would like to thank Bernabé de la Bat, Carinus Lemmer, David Botha, Gawie Groeneweld, Marita Nel and Angelika van der Merwe.

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List of Acronyms and Abbreviations

ANC	African National Congress
BRT	Bus Rapid Transit
ITP	Integrated Transport Plan
CITP	Comprehensive Integrated Transport Plan
CO_2	Carbon Dioxide
DA	Democratic Alliance
GRP	Gross Regional Product
ICLEI	International Council for Local Environmental Initiatives
IDP	Integrated Development Plan
ITP	Integrated Transport Plan
KPH	Kilometres per hour
MLP	Multi-level perspective
NCA	National Cycling Academy
NMT	Non-motorised transport
PRASA	Passenger Rail Agency of South Africa
PT	Public transport
PTIF	Public Transport Infrastructure and Systems Fund
SDF	Spatial Development Framework
SRA	Stellenbosch Ratepayers Association
SIG	Stellenbosch Interest Group
TIS	Traffic Impact Study
TIA	Transport/Traffic Impact Assessment
UCT	University of Cape Town
UNEP	United Nations Environment Programme

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1. Introduction

1.1 Background

As a global community we face many interrelated and complex problems. The dominant global socio-economic systems of our time generate and sustain extreme inequality and cause widespread ecological destruction (Sachs, 1999). As a result the ability of our planet to support life as we know it is diminishing rapidly, primarily due to the over-consumption of the elite (Sachs, 1999). The concept of sustainable development emerged as the global community began to recognise and respond to growing evidence that conventional development approaches were highly problematic and could not continue indefinitely (Mebratu, 1998).

Cities play a substantial role in the process of ecological destruction (Girardet, 2004; Davis, 2010; UNEP, 2009). It has been argued that human resource consumption and waste production is concentrated in urban areas and is occurring on a scale which cannot be sustainably endured by ecological systems. The transport sector is one of the primary contributors to this problem (Girardet, 2004).

In addition, it is widely acknowledged that urban transport systems are unsustainable due to the dominant and ever expanding role of the private car (Banister, 2007; Martin, 2009; Newman & Kenworthy, 1999; Paterson, 2007; Vasconcellos, 2001). Car dominated transport systems:

- Are heavily reliant on the consumption of unsustainable levels of non-renewable resources (chiefly oil)
- Produce unsustainable levels of waste emissions degrading local air quality and human health and making a substantial contribution to the problem of global warming
- Expose cities to great risk due to the uncertainty surrounding both the cost and supply of oil in the future
- Support energy intensive ways of life amongst the middle and upper classes which fail to recognise the very real existence of ecological limits
- Provide a high level of personal mobility at great expense to social and ecological systems
- Exacerbate and maintain high levels of inequality especially in developing countries
- Undermine the quality of urban life/public space to create “inhumane and inflexible urban space” (UNEP, 2009: 19)
- Support the inefficient and unsustainable use of land i.e. urban sprawl
- Encourage sedentary lifestyles and undermine social integration
- Are increasingly economically dysfunctional

(Gehl & Gemzøe, 2006; Kenworthy & Laube, 1999; Martin, 2009; Newman & Kenworthy, 1999; Paterson, 2007; Schiller *et al*, 2010; UNEP, 2009; Vasconcellos, 2001).

As I shall discuss in Chapter 2, the collective evidence suggests that car dominated transport systems are grossly unsustainable. The former executive director of the United Nations Environment Programme, Klaus Toerpfer, went so far as to say that "We are coming to the conclusion that there is no space for cars in cities" (Spiegel Online in UNEP, 2009: 19). The highly problematic nature of urban transport systems demands a transition towards systems which are sustainable and to urban forms which support sustainable modes of transport (Kenworthy, 2006; UNEP, 2009). Crucially, this involves supporting and enhancing the role of walking and cycling in urban areas by creating urban environments and public spaces designed for people rather than for cars (Gehl & Gemzøe, 2006).

Like urban areas across the globe South African towns and cities are struggling to address urban transport problems and the dominance of the private car (Behrens & Wilkinson, 2008). Stellenbosch is such a town and will be the focus of this research. The town is characterised by rising levels of traffic, a lack of sustainable transport alternatives, declining quality of public space and constant pressure towards urban sprawl (ARUP, 2007). As will be discussed in Chapter 4 and 5, there is a clear need to move towards a more sustainable transport system in Stellenbosch.

1.2 Topic Development

I have been interested in the subject of sustainable transport since 2006. In that year, while completing a project for my honour's degree in public policy, I investigated the issue of sustainable transport policy in Durban (South Africa). Since then, my interest in transport has endured, particularly with regard to the negative environmental and social impacts of car dominated transport systems.

I am now attempting to complete my M. Phil in Sustainable Development Planning and Management (Renewable and Sustainable Energy). Towards the end of 2010, I was required to develop a research topic for my master's thesis. This proved to be a challenging process. However, the issue of unsustainable transport remained a constant theme throughout.

My previous degree (B.Phil.) focussed heavily on sustainable energy and, therefore, I initially explored urban energy issues. Due to my interest in transport, I began to explore the relationship between urban form, energy use and transport. The transport sector is one the primary energy users in many cities due to the widespread use of fossil-fuel powered vehicles. I read several related academic journal articles. During this initial reading process, I was increasingly drawn to the radical/critical literature on cars and car dominated transport systems. I was particularly inspired by Matthew Paterson's work *Automobile Politics* (2007) which explored the broader political economy and cultural politics of the car. As a result, I began to explore the idea of researching the political economy of the car in South Africa and specifically the way in which the economic power of the car industry sustains this most unsustainable mode of transport.

During 2010 and 2011 I was based in Stellenbosch and, therefore, I initially sought to refine this topic by focussing on the political economy of the car in nearby Cape Town. My initial meeting with my supervisor focused on developing this approach. However, while continuing my reading in this area I became interested in the topic of car culture and the widespread acceptance of the car as a normal part of everyday life. So, for a brief period, I thought of exploring car culture amongst Stellenbosch students. I continued to read on this

subject and it became clear that any exploration of car culture would require an extensive self-education in cultural studies which was, perhaps, too far a leap from my sustainable development/politics academic background.

On moving to Stellenbosch from car orientated Durban, I noticed immediately the relatively high level of non-motorised transport (NMT) use amongst the town's residents. Due to my interest in sustainable transport, I was curious about the state of affairs in Stellenbosch. Overtime, I became keenly aware of the potential Stellenbosch had for enhancing the role of NMT but, also, of the town's transport problems, particularly the excessive use of the private car.

Increasingly, I became interested in the dynamics of the Stellenbosch transport system. In particular, I was curious as to whether or not any attempt was being made to develop a more sustainable transport system and, importantly, to preserve and support the high level of walking and, to a lesser extent, cycling that was already taking place.

At the same time my supervisor pointed me in the direction of transitions literature which explores the dynamics of change from a state of unsustainability to one of sustainability.

By the conclusion of this process, I had settled on a research topic. The proposed title for my thesis was: *The case for transition to a sustainable transport system in Stellenbosch*. Specifically, I sought to explore the current situation in Stellenbosch and the barriers to and potential for the development of a more sustainable transport system in the town.

I narrowed the focus of my research by primarily examining the town of Stellenbosch itself rather than the broader Municipal area that includes the settlements of Franschoek, Pneil and Klapmuts. During the research process I increasingly focussed on walking and cycling, and ways in which 1) these modes are threatened by rising car use and 2) can be supported and enhanced. This is primarily due to the people and documents I was able to gain access to during the research process. It also become clear that walking and cycling have a very important role to play in the transport future of Stellenbosch due to the specific characteristics of the town. This will be explored further in Chapter 4. While there will be some examination of public transport issues within Stellenbosch, they will not form the primary focus of this research project.

As a result of this process of topic refinement, I was able to develop the following research objectives.

1.3 Research Objectives

- To gain a thorough understanding of the dynamics of the Stellenbosch transport system from the perspective of sustainable transport and transition theory with a particular focus on walking, cycling and public space

- To gain a thorough understanding of the policy approaches of both the Municipality and the University with regards to transport

- To gain a thorough understanding of the barriers to a more sustainable transport system in Stellenbosch and

- To gain an insight into the innovations occurring in the Stellenbosch transport system

1.5 Significance of the Study

As will be discussed in detail in Chapter 2, there is a critical need for a transition to sustainable urban transport systems. As such, research in the field of sustainable transport is important. It helps to enhance our understanding of the problem, possible solutions and the obstacles to achieving necessary change. If cities fail to move towards more sustainable transport systems, their socio-ecological reproduction will come under increasing strain. Urban economies built on the ready availability of affordable fossil fuels will increasingly begin to falter (Hodson & Marvin, 2010). As I argue in chapter 2, the case for transition is strong.

There is a substantial amount of research on transport issues in Cape Town, largely as a result of the UCT Centre for Transport Studies. However, the Stellenbosch transport system has received relatively little attention. As a result, there is a lack of academic research on the non-technical elements of the Stellenbosch transport system. Research in this area is, therefore, clearly of importance.

1.6 Research Design

The research design is informed by the objectives listed above. The first element of the research design is a *literature review* which is necessary in order to develop both a comprehensive knowledge of current literature in the field of sustainable transport and also, importantly, to provide a theoretical framework with which to analyse the case of Stellenbosch. The *literature review* will therefore focus on sustainable development, transitions, the problem of unsustainable transport in urban areas, proposed solutions to the problem, barriers to these solutions and ways in which these barriers can be overcome.

In addition, this research involved the development of a *case study* examining transport in the town of Stellenbosch and the progress, or lack thereof, towards a more sustainable transport system. In order to develop the case study, field interviews were conducted and documents relating to the topic were acquired (Mouton, 2008; Neuman, 2011).

At the beginning of the research process I did explore the possibility of undertaking an internship with the Stellenbosch Municipality in the Transport, Roads and Stormwater department. This would have allowed me to incorporate an element of participatory observation into the research project and to gain a greater understanding of how the Stellenbosch Municipality transport department operates. However, due to time constraints and consistent delays on the part of the Municipality, I was unable to participate as an intern.

1.6.1 Case Study

This research project is centred on the construction of a case study analysing the transport dynamics of Stellenbosch from the perspective of sustainable transport and transition theory. According to Neuman (2011: 177), "[t]he study of cases tends to produce complex explanations or interpretations in the form of an unfolding plot or narrative story about particular people or specific events". In addition, case studies are useful when trying to

develop a "holistic understanding of the situation, phenomenon, episode, site, group or community" (Kumar, 2011: 127).

According to Kumar (2011: 127), "the use of multiple methods to collect data is an important aspect of a case study, namely in-depth interviewing, obtaining information from secondary records, gathering data through observations, collecting information through focus groups and group interviews, etc". This research project does precisely that by making use of interviews, various forms of documentation - including municipal policy, minutes of meetings and comments by interested parties on developments - to develop a "holistic understanding of the situation" in Stellenbosch.

1.6.2 Literature Review

During 2010, I completed by BPhil in Sustainable Development Management and Planning. During that year I built up a large amount of literature that is relevant to this study particularly from the *Sustainable Development*, *Sustainable Cities*, *Ecological Design for Community Building* and *Conventional Energy Systems* modules. A substantial proportion of this literature addressed issues of sustainable transport, energy efficient cities and sustainable urban form. This formed the basis of my theoretical understanding of urban sustainability issues and, therefore, serves as the intellectual foundation of this research project.

In order to gain a thorough overview of the literature on my topic, I conducted a comprehensive literature search. This gave me the confidence that I had located and examined as much of the relevant literature as possible. I work in the Stellenbosch University J. S. Gericke Library as a part time student assistant and I am intimately acquainted with the various online academic databases, which I used intensively and extensively during the course of my research. I systematically searched for literature using relevant search terms. In addition, I consulted the works of prominent figures within the field of sustainable transport.

1.6.3 Field Interviews

I began the research process with little knowledge of transport dynamics in Stellenbosch or the individuals/groups involved. Therefore, I had to begin a systematic process of meeting individuals in order to gain information/data and contacts for further interviews. A combination of non-probability purposive and snowball sampling was used to identify interviewees (Babbie, 2010: 193). Purposive or judgmental sampling involves the selection of units based on the "researcher's judgement about which ones will be most useful or representative" (Babbie, 2010: 193). Snowball sampling is a form of sampling "whereby each person interviewed may be asked to suggest additional people for interviewing" (Babbie, 2010: 193).

I began by speaking to Professor Christo Bester, who recently completed a piece on unsustainable transport trends in Stellenbosch (Bester *et al*, 2011). He supplied me with a number of Stellenbosch Municipal transport documents (see the table below). At this early stage, I then visited the Stellenbosch Municipality planning department seeking documentation in order to get a better picture of the situation in Stellenbosch. I was able to speak to a planner by the name of Barbara-Ann McEvoy Henning who was very helpful and gave me additional documentation on a CD. Crucially, she also gave me two important contacts within the Municipality who could help me with transport related enquiries. So the

process continued and I gradually developed a better understanding of the dynamics of the transport system in Stellenbosch and the people involved. Appendix A provides a list of meetings, formal and informal, as well as the documentation I received from the person concerned.

For the most part the interviews were semi-structured and were informed by the research objectives. Topics included:

- The dynamics of the Stellenbosch transport system
- The barriers and limitations experienced by the various role players during the course of their work
- Stellenbosch transport and land-use projects and policies
- Thoughts and opinions on cars, cycling, walking, public transport and car orientated urban land use

As I developed a greater understanding of the situation, my interviews became less flexible with the inclusion of specific questions about incidents, projects and policies. The majority of interviews were recorded on my laptop but in a few cases recording the interview was not possible and therefore I took extensive written notes. Later, I listened to the interviews again and the main themes and important quotes were recorded as notes.

1.6.4 Data Analysis

The collection of empirical data (field interviews, documents, policies, minutes) allowed for the development of a "narrative story" (Kumar, 2011: 127) about the transport system in Stellenbosch. Once this story had been pieced together, it was then analysed using the theoretical framework developed in Chapter 2 and the lessons drawn from the case studies in Chapter 3, in order to achieve the research objectives.

According to Mouton (2008: 108), data analysis:

"…involves "breaking up" the data into manageable themes, patterns, trends and relationships. The aim of analysis is to understand the various constitutive elements of one's data through an inspection of the relationships between concepts, constructs or variables, and to see whether there are any patterns or trends that can be identified or isolated, or to establish themes in the data".

In order to achieve this, it is necessary to employ content analysis. Content analysis involves "analysing the contents of interviews or observational field notes in order to identify the main themes that emerge from the responses given by your respondent or the observation notes made by you" (Kumar, 2011: 278). Content analysis was used to identify themes from the data. Relevant data was grouped under specific themes such as "Urban sprawl in Stellenbosch", or "Stellenbosch Transport Policy" and slowly the case study emerged.

1.7 Limitations

I experienced a number of limitations during the course of this research.

Firstly, my limited technical knowledge in the field of transport and traffic engineering was, at times, an obstacle. This was most evident in discussions and interviews with engineers and when examining technical documents such as Traffic Impact Assessments. However, it did not prove to be a ruinous barrier to the research process, especially given my non-technical approach to the issue.

Secondly, gaining a thorough understanding of a complex system within a short space of time is quite difficult. I had only a few months in which to do this. Had I greater time, I could have developed a deeper understanding, especially if I had been able to participate as intern within the Municipality. The fact that I approached this topic as an "outsider" was also a limitation.

1.8 Thesis Outline

Chapter 1 includes an introduction to the topic of this research project and describes how the topic was refined resulting in the development of research objectives. It also includes an overview of the research methods deemed necessary to achieve the research objectives. There is also a discussion of why this study is significant.

Chapter 2 is a review of the literature. It begins with a brief exploration of the concept of sustainable development and an overview of the problems faced by humanity including peak oil, global ecological destruction, inequality, excessive resource consumption and climate change. It then moves onto a discussion of the contribution of urban transport systems to these problems, with a particular focus on the role of automobile. Thereafter, I discuss the possible solutions to these problems which, if implemented, would allow for the development of a more sustainable transport system. I then explore the barriers and obstacles to the transition to a more sustainable transport system. The review then concludes with an exploration of the *transition* concept and its applicability to sustainable development and, in particular, sustainable transport. A theoretical framework was developed from the literature, to be applied to the case of Stellenbosch in Chapter 5.

Chapter 3 explores cases of cities and towns from around the world which have had success in moving towards more sustainable transport systems. This includes New York City, Copenhagen, Curitiba, Davis (California), Guangzhou, Freiburg and Bogotá. This chapter includes a review of the innovative policies and programmes adopted by these places and how they were able to successfully place themselves on the path towards a sustainable transport future. From this analysis lessons can be drawn for the town of Stellenbosch.

Chapter 4 synthesises data from interviews and documents to develop a "narrative story" of transport in Stellenbosch. It focuses on the dynamics of the Stellenbosch transport system, the role-players, the barriers to change and the attempts by various individuals/groups/institutions to pursue a more sustainable approach to transport.

In Chapter 5 I have applied the theoretical framework developed in Chapters 2 and 3 to the case of Stellenbosch. This allowed me to make sense of the trends and dynamics of the Stellenbosch transport system from the perspective of sustainable transport and transition theory. In addition, I explore the contribution of this thesis to the broader transitions literature.

Chapter 6 will provide an overview of the thesis, concluding arguments and areas for further research. By this stage of the thesis the conclusion has been reached that change in the

Stellenbosch transport system in hindered by the strength of the “system of automobility”. In order to overcome this obstacle, the dominant regime needs to be contested through innovation.

2. Literature Review

2.1 Introduction

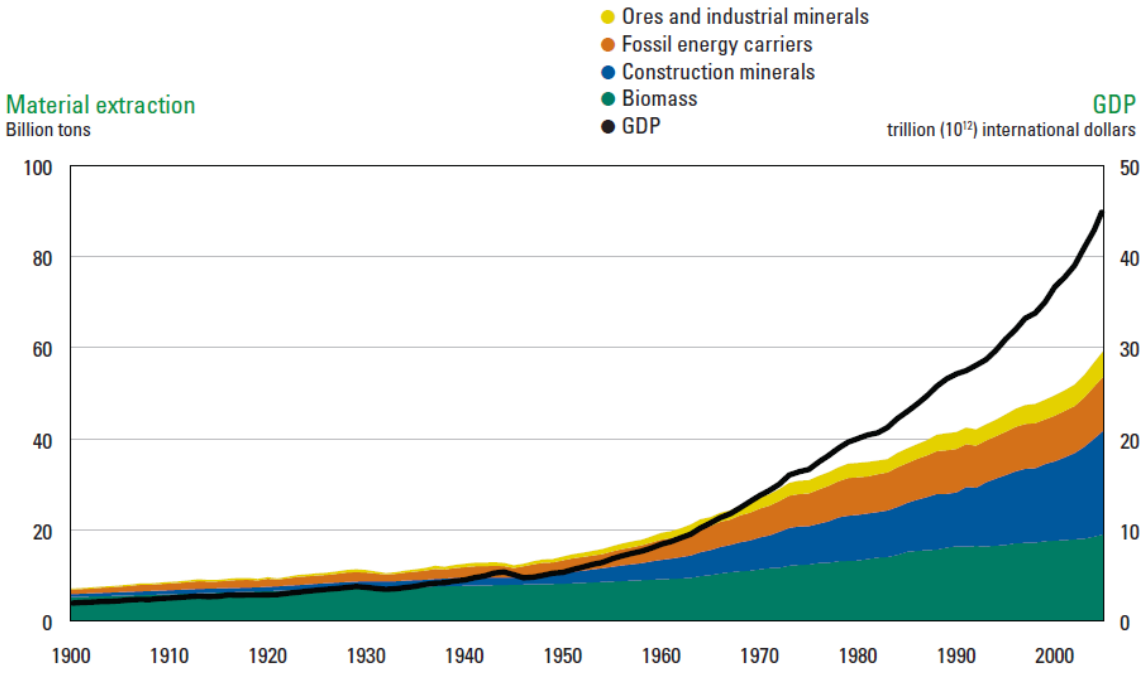
"Burgeoning levels of energy consumption, enhanced levels of ecological degradation, a growing public mistrust of science, vast inequalities in economic opportunities both within and across societies, and a fractured set of institutional arrangements for global environmental governance; all represent seemingly insurmountable obstacles to a move towards sustainability."

(Sneddon *et al*, 2006: 263).

As a concept, sustainable development emerged in response to growing evidence of humanity's detrimental impact on ecological systems (Dresner, 2008). Towards the end of the 20th century, it became increasingly clear that conventional development and economic growth occurs in concert with ecological destruction and global social inequality (Sachs, 1999). As a result alternative, sustainable forms of development are necessary for an ecologically and socially balanced planet to become a reality (Sachs, 1999).

Today, we sit with a situation in which nearly every ecological system on earth is under stress; resources are rapidly being depleted and the global climate is becoming increasingly unstable (Hodson & Marvin, 2010b). Humanity relies on the extraction and use of vast quantities of resources and ever growing quantities of waste to maintain current ways of life (see Figure 2.1 below). Between 47 to 59 billion tons of construction minerals, ores and industrial minerals, fossil fuels, and biomass are harvested annually (UNEP, 2011), and in 2010 CO_2 emissions from the energy sector rose to a record level of 30.6 Gigatonnes (IEA, 2011a).

Figure 2.1 Global material extraction in billion tons, 1900 - 2005



Source: Krausmann et al, 2009 in UNEP, 2011

At the same time global inequality has been growing substantially (Davis, 2010; Gills, 2010; Sachs, 1999). Global ecological destruction occurs primarily to support the global middle and upper classes that consume the majority of resources and produce the majority of wastes, exceeding ecological limits (Swilling, 2005). As a result, sustainable development cannot be viewed simply as an environmental issue for it is also an issue of social justice (Hattingh, 2001; Sachs, 1999). As Girardet (2004: 18) argues:

"Europe, America, Japan and Australia, with their unprecedented dependence on fossil fuel-based technologies and processes, their complex technical infrastructure and their ever-growing consumerism, are currently the most unsustainable regions of the planet".

As such, it is argued (Gallopin, 2003; Girardet, 2004; Sachs, 1999) that developing countries, like South Africa, should learn from the mistakes of the developed world and pursue alternative, sustainable development paths rather than blindly following the unsustainable lead of "Europe, America, Japan and Australia" (Girardet, 2004: 18). The wealth and consumerism of the developed world may appear an attractive prospect but in reality it is, in many respects, unsustainable and wholly dependent on ecologically and socially destructive resource consumption and waste generation. Despite this, rapidly industrialising developing countries are, in many cases, emulating the unsustainable development paths of richer nations (Baeten, 2000; Kenworthy, 2006, Martin, 2009). The challenge for developing countries is to "achieve the necessary growth but with far lower resource use" (Ness, 2008: 288). As I will argue later, the transport sector will be vitally important in this process.

It is clear that change is necessary in order to develop a more sustainable human existence. The current trajectory simply cannot continue indefinitely because it is based on the premise of unlimited growth when, in fact, the limits to conventional growth are very real (Gallopin, 2003). The "socio-ecological system" (Gallopin, 2003) is a term which refers to the complex, systematic interaction between human socio-economic systems on the one hand and ecological systems on the other. The term denotes humanity's deep dependence on functioning ecological systems and the eco-system services they generate, i.e. fresh air, fresh water, healthy soil, timber, plants, minerals etc. (Gallopin, 2003). In order to sustain the socio-ecological system, the resources and wastes consumed and produced by human socio-economic systems must stabilise at a level which does not exceed ecological limits (Gallopin, 2003). This will necessarily require a reduction in consumption by the rich (dematerialisation), a rise in consumption by the poor to meet their development needs and a total stabilisation of global resource consumption/waste generation which is in balance with ecological limits (Gallopin, 2003; Sachs, 1999). The development of sustainable urban transport systems would support a future which requires fewer resources, less waste and is socially equitable.

Although there are multiple interpretations of sustainable development and how it should be achieved, broadly speaking the objective is "a socially just and ecologically sustainable world" (Sneddon *et al*, 2006: 261). Ultimately human well-being must be separated or de-coupled from ecological destruction, i.e. the unsustainable consumption of resources and production of wastes. As we shall see below the urban transport system is one of the chief contributors to global unsustainability and change within this system is key to the sustainability of the socio-ecological system as a whole (Gallopin, 2003).

2.2 Unsustainable cities

"High levels of consumerism give cities mushrooming ecological impacts, implicating urban residents in a global ecological footprint which is out of control in respect to the size of the city and its resource base".

(Chatterton, 2010: 239).

Cities are the primary site of resource consumption and waste generation (Girardet, 2004), being responsible for up to "75% of global energy consumption and carbon emissions" (Hodson & Marvin, 2010b: 299). As a result they contribute significantly to global environmental degradation. At the same time the majority of the world's population now resides in urban areas (UNEP, 2009). It is principally in these large human settlements that humanity must develop more sustainable ways of life (Davis, 2010; Pieterse, 2008; UNEP, 2009; UNEP, 2011).

Infrastructure (roads, sewers, pipes, cables) facilitates the flow of resources and wastes which support daily life in cities. Along these infrastructure networks flow food, energy, water, cars, waste and information, which are essential for the reproduction of a particular kind of city life. This is known as the *metabolism* of the city, sustained by the *metabolic* flow of resources and wastes (Girardet, 2004). In order to develop more sustainable urban settlements the infrastructure, flows and ways of life they support must be adapted in ways which help to sustain rather than degrade the socio-ecological system (Gallopin, 2003).

As was mentioned earlier, one of the greatest sustainability problems is the ever expanding consumption of resources by the middle and upper classes who lead energy/resource/waste intensive lives that are over reliant on diminishing supplies of natural resources (oil, fresh water, arable land, ecological sinks, and fresh air). The urban transport sector, characterised by the extensive and growing use of the car as the primary means of urban transport, is one of the most prominent examples of this trend (Banister, 2007; Martin, 2009; Newman & Kenworthy, 2006; Paterson, 2007; Urry, 2004). This will be explored in depth in the next section of this chapter.

Despite being central to the process of unsustainable development, it has been argued (Davis, 2010; Hodson & Marvin, 2010b, UNEP, 2011) that cities, as sites of concentrated capacity, knowledge and resources also hold the key to a sustainable future (UNEP, 2011). Davis argues that cities, in both rich and poor countries, must embrace the "potential environmental efficiencies inherent in human-settlement density" so as to unleash the "ecological genius" of the city (Davis, 2010). In response to growing resource scarcity and ecological instability, cities around the world are increasingly taking action to reconfigure their infrastructure in order to secure their material reproduction (Hodson & Marvin, 2010b). By "integrating local production technologies, circular metabolisms and closed-loop systems" (Hodson & Marvin, 2010b: 308), cities are enhancing their resilience in the face of mounting threats to the continuation of conventional development trajectories. To achieve this, cities and towns need to retrofit "existing urban environments to reduce energy and water use, accelerate low-carbon technologies, and provide affordable energy for all users" (Hodson & Marvin, 2010b: 311). Retrofitting sprawling, car dominated cities will be key to this process. The role of infrastructure is important because it can either facilitate or hinder sustainable livelihoods. Moreover, infrastructure networks have been described as socio-technical systems (Guy & Marvin, 2001). For example, the choice to build a freeway or to pedestrianise a city centre is not simply a technical decision, it is socially determined. The role of politics is central (Vasconcellos, 2001).

In many places around the world, urban areas are struggling to cope with rising levels of car use and its detrimental effect on urban sustainability (Martin, 2006; Martin, 2009). As will be argued below, car dominated transport systems are not sustainable not least because of their dependence on fossil fuels and their consequent substantial contribution to the problems of local air pollution, resource scarcity and global warming (Schiller *et al*, 2010). Sustainable development, achieved through a reduction in resource consumption and waste production, requires a move away from the car as the dominant mode of urban transport.

2.3 The system of automobility

"[The system of automobility is] an extraordinarily powerful complex constituted through technical and social interlinkages with other industries, car parts and accessories; petrol refining and distribution; road-building and maintenance; hotels, roadside service areas and motels; car sales and repair workshops; suburban house building; retailing and leisure complexes; advertising and marketing; urban design and planning; and various oil-rich nations".

(Freund, 1993 in Urry, 2004: 26).

This quote provides an insight into the entrenched strength of the global "system of automobility". It illustrates how a complex and powerful set of institutions, infrastructures and economic activities perpetuates this system. In effect, the quote describes a socio-technical regime, a concept which I will explore in greater depth towards the end of this chapter. Despite the power and the growing global reach of this system there are examples of urban areas around the world (see Chapter 3) which have successfully been able to control the growth in car use and limit the negative social, ecological and economic effects that accompany its widespread use.

Car use is growing around the world, most notably in the rapidly industrialising developing nations (Martin, 2006; Martin, 2009). China and India are experiencing an "urban transport crisis" partly because of strong economic growth and a simultaneous dramatic increase in car "ownership and use" (Pucher *et al*, 2007: 379). Between 1991 and 2003, "the number of cars per 1000 population in China rose from fewer than two to almost ten - a fivefold increase in only 12 years" (Pucher *et al*, 2007: 389). In 2002 there were approximately 500 million cars globally and, currently, 50 million cars are produced annually (Banister, 2007; OICA, 2011). Concurrently, the total number of vehicles in operation around the world continues to rise (see Figure 2.2 below).

In, arguably, the most car dominated country on earth, the United States, car ownership stands at 790 vehicles per 1000 people (Martin, 2009). When compared to other areas around the world, car use in American cities is staggeringly high: "US cities are 70% higher in car use than their nearest rivals, the Australian and Canadian cities, 2.5 times higher than the wealthier European cities and 7.5 times higher than the wealthy Asian cities" (Kenworthy & Laube, 1999: 700).

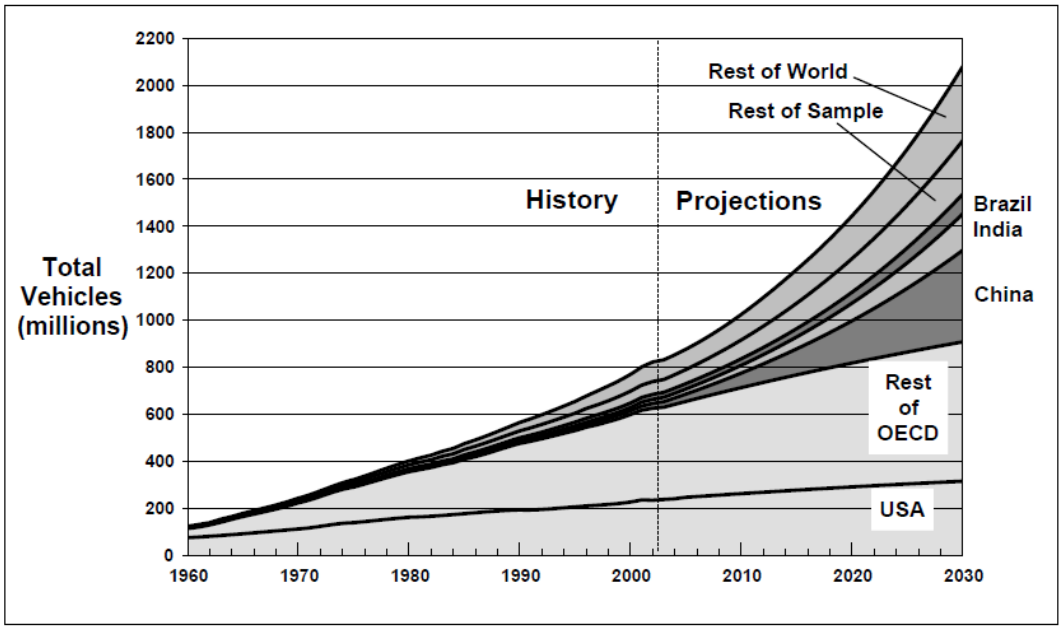
The United States has entered a stage of 'hyperautomobility' as Martin (2006) explains:

"The latest development is that auto social formations have become the platform for a deepening and broadening of personal car use – a hyperautomobility featuring (1) a saturation of car ownership (one car per adult), (2) high level of car travel and (3) low vehicle occupancy. Thus, while the number of vehicles per household in the USA increased by a modest 6 per cent between 1983 and 1995, the number of trips increased by 56 per cent, the

length of trips by 15 per cent and the number of vehicle occupants declined by 9 per cent. The difference between auto-centred transport and hyperautomobility is demonstrated by changes in vehicle miles (VMT) or kilometres (VKT) of travel. From 1950 to 1980, VMT in the USA increased by just 1 per cent, but from 1980 to 2000 it went up 30 per cent. In addition to more miles and more solo driving, hyperautomobility is associated with a shift to larger vehicles such as sports utility vehicles (SUVs)".

(Martin, 2006: 67).

Figure 2.2 Total vehicles, 1960 - 2030



Source: Dargay et al, 2007

Hyperautomobility is the pinnacle of unsustainable transport. It represents a flagrant disrespect for ecological limits and social justice. It has occurred as a result of decades of pro-car policies in the United States, including low fuel prices, poor quality public transport and car orientated city infrastructure (Buehler, 2010). It is also associated with a high level of automobile dependence, where having a car becomes essential for effective participation in society due to sprawling urban forms and the lack of viable alternatives:

"Connections with the world outside the household necessarily are made via automobile. Going to work, to school, to shop, to leisure activities, etc., requires a car. If one does not have a car or cannot drive, then one is either chauffeured or does not travel".

(Freund & Martin, 2007: 41).

According to Martin (2006; 2009), this United States style 'hyperautomobility' is precisely what the developing world should be trying very hard to avoid.

Henderson (2006) argues that growing levels of car use are often met with a sense of defeatism as decision makers resign themselves to the belief that widespread car use is an inevitable part of economic development:

"Broadly, automobility is cast as a natural result of the free market and technology, and although there are many unfortunate side effects, people 'naturally' want to drive and will continue to choose to drive regardless of public policies targeted to reduce driving".

(Henderson, 2006: 295).

While 'hyperautomobility" does allow for unprecedented levels of individual mobility and convenience, it is only possible because of the complex "system of automobility" described earlier and it comes at great cost to society, the environment and increasingly the economy (Freund & Martin, 2007; Kenworthy & Laube, 1999; UNEP, 2009).

Henderson argues that the car is often defended as being an important expression of individual freedom. In reality, he argues:

"…automobility derives from a system calculated to coerce individuals into driving, that subordinates all other modes of transport and ways of dwelling, that requires enormous state subsidy and regimentation of urban space for maximum throughput and speed, and requires a centralized state-backed capitalist oligopoly of oil, highway, automotive manufacturing and real estate control over transportation policy".

(Henderson, 2006: 295).

The result, according to Martin (2006), is a very particular type of urban landscape; one in which access and amenity is greatest to those with cars:

"The transport infrastructures of this motorized urban sprawl…interact with natural topographies and built environments to create the signature habitats of auto social formations, including far-flung exurbs, corporate campuses, malls, gated communities and big-box stores. This social formation has become typical in the urban USA. Its basic parameter is low densities for living, working, travelling and other activity sites".

(Martin, 2006: 67).

As a result of the problems generated by automobile dominance, the view that it is inevitable has, increasingly, been challenged (Low & Gleeson, 2001; Henderson, 2006). It is clear that some cities have the "automobile much more under control" than others due to specific characteristics including the higher cost of motoring, the presence of viable alternatives to the car and urban forms which support these alternatives (Kenworthy & Laube, 1999: 718).

Rising "levels of motorization…are taxing the capacities of governments around the world" (Martin, 2006: 66), who are pressured to devote resources to cater adequately for the extensive requirements of mass car use. However, there are several towns and cities around the world which have successfully restricted car use while achieving high levels of prosperity and well-being (Girardet, 2004). Zurich, for example, one of the wealthiest cities on the planet, has one of the highest levels of transit use in the world (Kenworthy & Laube, 1999). Kenworthy & Laube (1999) argue that wealth and economic prosperity do not necessarily result in uncontrolled, automobile dependence. They argue that "within the developed cities with comparable wealth levels, car use per capita, car ownership and transit use bear little relationship with wealth" (Kenworthy & Laube, 1999: 718). Rather, they argue, "urban form, in particular higher urban density, is consistently associated with lower levels of car ownership and car use, higher levels of transit use, and lower total costs of operating urban passenger transportation systems" (Kenworthy & Laube, 1999: 719). In other words, transport systems dominated by the car are not an inevitable by-product of progress.

One important reason for the continuing strength and expansion of car use is the power of the car/oil industrial complex (Paterson, 2007). The car and oil industries play a major role in the global economy:

"Traffic production is, like other sectors, an integral part of the capitalist economy which is subjected to the imperatives of growth and restless expansion if it is to survive…Transport volumes will tend to increase systematically under the economic pressures which force producers of transport means and transport services to expand their businesses at an ever faster pace".

(Baeten, 2000: 81).

As a result the "system of automobility" has proved to be "remarkably stable and unchanging" despite a rising recognition that car dominated transport systems are unsustainable (Dennis and Urry, 2009: 240). Many countries around the world actively promote their car industries as central pillars of their national economic development strategies (Paterson, 2000). The relationship between the important economic role of car production and the urgent need to restrain urban car use is worthy of further investigation but is beyond the remit of this research project. Rather, this thesis is an attempt to explore whether or not transition is possible in Stellenbosch, in spite of the power of the "system of automobility".

The above discussion provides an insight into the global context in which the Stellenbosch transport system is situated. The power of the global system does not, necessarily, present an insurmountable barrier to local transport system change in Stellenbosch given that other cities and towns around the world have been successful in controlling car use and in adopting innovative approaches to urban transport (see Chapter 3). So, despite the global strength of this system "societies are making efforts to correct their courses, in the interests of economic efficiency, as well as social inclusion, community cohesion, environmental integrity, and public health" (Freund & Martin, 2007: 47).

It is worth reflecting on Urry's opinion, in reference to the car: "This mode of mobility is neither socially necessary nor inevitable" (Urry, 2004: 27). This is consistent with an increasing recognition that privately owned cars are not *necessarily necessary* in urban environments (Banister, 2011; Peñalosa, 2006; UNEP, 2009). Rather, it is argued that "public transport (and taxis) could accommodate all travel needs, with a much greater degree of local movement possible by walk and cycle" (Banister, 2011: 5).

2.4 Unsustainable urban transport

In this section I will briefly explore the multiple arguments which cumulatively suggest that car dominated transport systems are entirely unsustainable. As a result, urban areas around the world need to find ways of achieving sustainable development without widespread car use and the related ecological, social and economic dysfunction that this entails.

2.4.1 Energy, oil, environment and the car

"[The system of automobility is the] single most important cause of environmental resource-use. This results from the scale of material, space and power used in the manufacture of cars, roads and car-only environments, and in coping with the material, air quality, medical, social, ozone, visual, aural, spatial and temporal pollution of global automobility. Transport

accounts for one third of CO_2 emission and is indirectly responsible for many 20th century wars''.

(Urry, 2004: 26).

As the above quote elucidates, widespread car use is currently causing catastrophic damage to local and global ecologies. Cars produce a wide array of local air pollutants which undermine air quality and human health. These include "carbon monoxide, volatile organic compounds (VOC), various oxides of nitrogen (precursors to ozone pollution) and fine particulates" (Greene and Wegener, 1997: 179). Cars are also one of the chief contributors to the problem of global warming because they burn energy rich, CO_2 producing fossil fuels in order to operate. Fossil fuels currently satisfy "80% of the world's energy needs" (Atkinson, 2011: 316). In the transport sector 90% of the energy consumed is in the form of oil (Atkinson (2011: 318) and half of this is consumed by private cars, 30 per cent by freight and 13 per cent by air travel (Atkinson, 2011: 211). Table 2.1, below, gives an indication of transport energy use in the developed world. The effect of hyperautomobility on energy use in the United States is clear.

Table 2.1 Transport energy use and efficiency in higher income regions, 1995

Overall Transport Energy Indicators	Units	USA	Western Europe	High-income Asian
Private passenger transport energy use per capita	MJ/person	60,034	15,675	9,556
Public transport energy use per capita	MJ/person	809	1,118	1,423
Energy use per private passenger vehicle km	MJ/km	4.6	3.3	3.3
Energy use per public passenger vehicle km	MJ/km	26.3	14.7	14.4
Energy use per private passenger km	MJ/p.km	3.25	2.49	2.33
Energy use per public transport passenger vehicle km	MJ/p.km	2.13	0.83	0.48
Overall energy use per passenger km	MJ/p.km	3.20	2.17	1.40

Source: Kenworthy & Laube, 2001 in Kenworthy, 2007

Transport produces 26% of global CO_2 emissions, with road transport accounting for 65% of this (Chapman, 2007: 355 – 356). Sperling and Clausen (2002: 60) argue that "[w]orldwide, GHGs (greenhouse gases) are rising faster in transportation than in any other sector, and fastest of all in developing countries". Clearly, the high level of fossil fuels consumed by cars is problematic given that it damages human health and is a threat to the ecological stability of the entire planet.

The relationship between urban form and energy use is also of relevance here. Widespread car use often goes hand in hand with sprawling, low density urban formations. Cities of this type are associated with high overall levels of energy consumption (Kenworthy & Laube, 1999; Rickwood *et al*, 2008). Long distances between locations increase the energy required to negotiate daily life in a sprawling city and undermine alternatives to the car. Rickwood *et al* (2008: 57) argue that "there is clear evidence from both intra-and inter-city comparisons that higher density, transit-orientated cities have lower per-capita transport energy use".

According to the UNEP (2011), high population densities are associated with lower rates of resource consumption (including energy) without any significant decreases in quality of life. Cheap energy/oil has made low density, energy intensive, urban sprawl possible. Increasing energy constraints place the long term future of this urban form in doubt (Newman, 2007).

Key to this debate is the issue of peak oil. The supply of oil is finite and it is widely argued that demand for oil will soon outstrip supply, if it has not already (Atkinson, 2011; Heinberg, 2009; Newman, 2007). Almost 90 million barrels of oil are consumed per day, with a total of 4 billion tonnes of oil consumed in 2010 (BP, 2011). Oil consumption is growing by between 1 and 3 million barrels a day (IEA, 2011b).

The continued and growing dependence of urban transport systems on oil is highly problematic, given that its supply is finite (Banister, 2011). It exposes urban areas to the risk of serious instability and uncertainty in the future. Some argue (Atkinson, 2011; Heinberg, 2009) that without a radical move away from fossil fuel dependence, the global economy faces the risk of "extreme, economic decline" (Atkinson, 2011: 315). The dependence of our cities, our economic systems and our way of life on oil is a critical threat to the future stability and resilience of the socio-ecological system:

"So, cutting through the thicket of the voluminous debate on 'sustainable development' we come eventually to the simple truth: our use of energy is unsustainable and when it comes to an end then the whole economic and social (and political) structure of our world falls apart".

(Atkinson, 2007: 206).

Others argue that while peak oil will certainly be disruptive, especially for unprepared urban areas, it will not necessarily be a civilisation ending event. Many cities could adapt to an energy restricted future but it is the automobile dependent cities which will be hardest hit:

"…there are many cities that use hardly any fuel (such as Chinese and Indian cities at round two GJ per person); many that are very wealthy use only a modicum of oil and could easily adapt to almost nothing (e.g. Tokyo and Barcelona use 8 GJ per person) while most U.S., Canadian, and Australian cities use frightening amounts of fuel (Australian and Canadian cities average around 30 GJ; U.S. cities average 56 GJ with Atlanta the highest at 103 GJ per person)".

(Newman, 2007: 19).

A rapid movement away from oil and by extension automobile dominance is, therefore, essential for urban resilience in the face of increasing uncertainty regarding the future supply of energy.

According to Kenworthy (2007), some argue that energy efficient, hydrogen fuelled or electric powered cars can resolve the problems described above (Kenworthy, 2007). However, these technologies only address the energy/environmental implications of widespread car use and fail to address the issues of social inequality, the quality of public space, road safety and urban sprawl; which will be explored further below (Steg and Gifford, 2005: 60). In addition, increased vehicle efficiency may simply encourage greater overall car use by keeping it affordable in the context of rising energy prices (Kenworthy, 2007).

As I will discuss later in this chapter, there are a number of ways in which cities and towns can become less dependent on oil, now and in the future, by strongly supporting sustainable modes of transport including transit, walking and cycling and by implementing measures to

restrict car use (Schiller *et al*, 2010). For now, I will continue with an exploration of the relationship between car dominance and sustainable development.

2.4.2 Social impact

"Automobility has become a determinant architectural, geographical and environmental influence that affects social ecologies in unique and powerful ways – segregating classes, severing neighbourhoods, privatising public space, creating massive scales of operation, and leaving large ecological footprints" .

(Martin, 2002 in Martin, 2009: 228).

As the above quote indicates, widespread car use has a detrimental effect on the quality of urban life and, especially in developing countries, on the level of urban inequality. The United Nations Environment Programme has suggested that "car based urban development creates inhumane and inflexible urban space" (UNEP, 2009: 19). Below I will explore the social impacts of car dominance.

2.4.3 Inequality

"Car use in developing cities is very regressive: It absorbs massive public investments for road infrastructure building and maintenance, taking resources away from the more urgent and important needs of the poor; creates traffic jams that hinder the mobility of the bus riding majorities; pollutes the air; makes noise; leads to accidents; creates obstacles to lower income pedestrians; and leads to a progressive invasion of scarce pedestrian spaces by parked vehicles".

(Peñalosa, 2006: 6).

The relationship between transport and inequality is one of the most critical transport issues in developing countries, like South Africa. As a result of unrestrained car use, cities sprawl, distances grow, public space is invaded by cars and collectively these processes place the poor at a distinct disadvantage. Fotel (2006: 733) describes the transport experience of the poor as follows, "Their lives are defined on the premises of others' mobility and they are increasingly pushed aside, reduced to living with the side effects that others' mobility causes".

Work, education and health care services all become more difficult and more costly to access for the poor. Those unable to own and operate a car are forced to rely on public transport, often of poor quality, or walking and cycling, which struggle to provide a viable alternative in an urban environment designed primarily to facilitate car use (Vasconcellos, 2001).

Long distances and low density sprawl make public transport expensive and energy intensive. Urban space designed for the car makes walking and cycling dangerous and unfeasible given the ever growing distances between locations:

"Even when journeys are short…the dominance of traffic and its expropriation of otherwise attractive spaces makes walking and cycling an unpleasant, if not daunting, prospect".

(Owens, 1996: 48 in Vasconcellos, 2001: 185).

As a result the "poor are confined by their lack of mobility in prisons with invisible walls" (Adams, 1996: 13 in Baeten, 2000: 83).

Rather than enhancing freedom, automobile dependent urban forms coerce individuals into buying cars as they have no other choice if they want to function effectively in a car-oriented society (Henderson, 2006; Urry, 2004). As Vasconcellos (2001: 157) argues:

"Considering the prevailing built environment, the ease of automobile use and the poor supply of public transport means, the middle class has no alternative but to purchase and use the car intensively".

According to Vasconcellos (2001) and Baeten (2000), car dominated cities are the physical expression of the power of the middle class to reproduce cities and towns in ways which primarily favour them. Part of the problem is that decision makers, planners and engineers are usually car-driving members of the middle class and therefore have a stake in reproducing car dominated cities which facilitate contemporary, unsustainable, over-consuming lifestyles (Vasconcellos, 2001).

In a developing country car dominance is deeply problematic given that the majority of people do not drive. In the absence of effective alternatives, it is one of the greatest impediments in the lives of individuals and families living in poverty and makes a significant contribution to the perpetuation of urban inequality. Vasconcellos (2001) makes the following argument in this regard:

"As the satisfaction of all needs is impossible, and as traffic management decisions are not neutral, every circulation space is physically marked by past policies, revealing the dominant interests that shaped them. The physical arrangement of most large cities in developing countries is proof of the shaping of circulation space for the most powerful roles, especially the driver, and, more directly, the middle-class driver. Cities were adapted to the convenient circulation of automobiles at the expense of other interests, especially pedestrians and public transport users. However, the organisation of these aggressive built environments did not prevent the weakest roles from finding their space. No role is totally rejected, or limited on a city-wide scale, but the weakest have to submit themselves to the needs of the strongest".

(Vasconcellos, 2001: 71-72).

Vasconcellos (2001) argues that transport decision making is not neutral, despite the aura of neutrality bestowed upon it by technical decision making techniques and criteria. Over time, cities are shaped in a way which benefits some and disadvantages others. It is impossible to appease the multiple competing demands of car drivers, public transport users, pedestrians and cyclists for scarce urban space. For example, "To install a pedestrian crossing means an increase in pedestrian safety but a decrease in driver fluidity" (Vasconcellos, 2001: 73).

In such cases decision makers have often favoured the driver and as a cumulative result we have urban areas in which the car dominates. As Peñalosa (2006: 4) argues: "[u]rban transport is a political rather than a technical issue". Baeten argues that it is important for us to recognise the "deeply contested ways and means through which transport infrastructures are being planned and developed, and how they all lead to a clash between diametrically opposed mobility interests that inevitably generate winning and losing groups" (Baeten, 2000: 70). Similarly, Vasconcellos argues that "since it is impossible to simultaneously address all needs and interests, it is necessary to ask which role is being favoured by the intervention, and which is being harmed" (Vasconcellos, 2001: 74). Clearly, transport decision making is deeply political, and it can be argued that the specific characteristics of any given urban transport system reflect the power dynamics within that

town or city. This approach can be applied to the town of Stellenbosch. As I will argue in Chapters 4 and 5, it is clear that past decision making in Stellenbosch has, primarily, favoured the car. The urban environment in the town facilitates widespread car use and does not cater adequately for alternative, sustainable modes of transport. As such, it is increasingly a place best suited to the reproduction of the middle class minority, rather than the poor majority.

In the next section, I will explore the ways in which widespread car use can lead to deterioration in urban public space, which is so essential for social cohesion, public health and sustainable development.

2.4.4 Public space and privatised lives

"Car-based cities are not human scale and cannot deliver…quality public environments".

(Kenworthy, 2007: 65).

"The more a city is made to accommodate motor vehicles, the less respectful of human dignity it becomes, and the more acute the differences in quality of life between upper income and lower income groups".

(Peñalosa, 2006: 6).

The above quotes clearly reflect the argument that widespread car use has a detrimental effect on the quality of public space (Freund & Martin, 2007; Gehl & Gemzøe, 2006; Kenworthy, 2007). Cities, their public spaces and their streets have traditionally been used as meeting place, marketplace and traffic space (Gehl & Gemzøe, 2006: 10). In the past, streets were dominated by people. However, in the 20th century this began to change. As car use grew, particularly after World War II streets were increasingly designed to meet the needs of the car. It was no longer safe for pedestrians to walk or for children to play in the street and the space for pedestrians rapidly began to decline. Towns and cities around the world were redesigned to facilitate car use and the quality of the public realm was diminished as a result. In some places, distances began to grow and this, combined with growing levels of car traffic, made walking an unsafe and unpleasant mode of transport. The extent to which this took place differs throughout the world. Venice is probably the most extreme example of a city in which the streets have retained their multiple uses as vital public space due to the absence of cars. For Gehl & Gemzøe (2006) the car dominated city is the invaded city which they describe as follows:

"Car traffic and parking have gradually usurped space in streets and squares. Not much physical space is left, and when other restrictions and irritants such as dirt, noise and visual pollution are added, it doesn't take long to impoverish city life. It becomes unpleasant and difficult to get around on foot, and spending time in public spaces is made impossible by lack of room and environmental problems. The result in city after city is that only the most essential foot traffic battles its way between moving and parked cars, and only a severely amputated selection of other activities can be found".

(Gehl & Gemzøe, 2006: 14).

Today, streets often exist primarily to facilitate car movement and as a result the quality of public space, the safety of pedestrians and cyclists and the mobility of the poor have suffered:

"…modernist urban landscapes were built to facilitate automobility and to discourage other forms of human movement. . . .[Movement between] private worlds is through dead public spaces by car".

(Freund, 1993: 119 in Urry, 2004: 30).

Quality public space is especially important in developing countries where the poor do not have access to private gardens, country clubs or golf courses. Urban squares, parks, streets and pedestrianised areas are often the only spaces available for the recreation of the poor (Peñalosa, 2006).

In addition, the space requirements of car dominated transport system for roads and parking are vast. In Los Angeles, arguably the most automobile dependent city on the planet, "two-thirds of all land space is devoted to car use" (Paterson, 2000: 260). This scarce urban space could, potentially, be used for more important purposes and serves as yet another warning of the future that awaits cities if they continue to pursue a car orientated development path (Gehl & Gemzøe, 2006).

It has also been argued that the dominance of the car supports a particular view of the modern individual and urban citizen, with the focus on individual self-gratification rather than a concern for social and ecological well-being. As Gorz (1973: 70) argues:

"Mass motoring effects an absolute triumph of bourgeois ideology on the level of daily life. It gives and supports in everyone the illusion that each individual can seek his or her own benefit at the expense of everyone else".

In line with these arguments and in reference to the increasing sprawl and suburbanisation experienced in North America, David Harvey argues that "this is a world in which the neoliberal ethic of intense possessive individualism, and its cognate of political withdrawal from collective forms of action, becomes the template for human socialization" (Harvey, 2008: 9). Kunstler (1996 in Schiller *et al*, 2010: 15) argues that car dependent lifestyles and suburban living are a way of escaping urban realities and "deny the very nature of what it means to live in a city with all the attendant responsibilities of being a citizen and not just an individual maximising his or her private benefits". In effect, the car and isolated suburbs allow the middle classes to escape from the reality of urban life. As Henderson (2006: 294) argues, "Households react to poor schools, urban crime, different racial groups, or any other perceived or real urban problem by seceding from spaces where these problems exist". Car based lifestyles allow the middle class to absolve itself from the reality of the city (Henderson, 2006).

From the above arguments, it is clear that the car has a detrimental effect on the quality of urban public space, is a powerful force in shaping the built environment and is part of a growing loss of social cohesion in urban areas. While many of these arguments focus on the urban United States, the dramatic rise in car use and car orientated urban forms in many parts of the developing world suggests that these problems are, or may become, a reality there to.

2.4.5 Public health and well-being

In addition, widespread car use, unsafe and unattractive public spaces, sprawling cities and poor quality walking/cycling infrastructure has seen a decline in physical activity. For many, walking or active travel is no longer a necessary part of daily life and this has contributed to

the rise in obesity, heart disease and other illnesses (Freund & Martin, 2007). The creation of dense, mixed use, walking/cycling friendly urban spaces is therefore an important public health initiative. The decline in safe and attractive walking environments has also severely restricted the ability of children to walk and play on the streets of the city:

"…independent mobility of children has been strongly curtailed during the last two decades. Autonomous use of the street, certainly among 7 and 8 year old children, has virtually disappeared".

(Baeten, 2000: 82).

And of course, we should not forget that widespread car use comes at an extraordinary high cost to global health and wellbeing. Cars are extremely dangerous with about one million people "killed each year in road crashes, and many millions more injured" (WHO, 2003 in Freund & Martin, 2007: 45).

From the arguments presented above, it is clear that widespread use of the car has significant social impacts that suggest it cannot continue as the dominant form of urban mobility indefinitely.

2.4.6 Urban form and transport

"…urban sprawl binds us to an everyday life utterly dependent on the automobile and fossil-fuel driven transport".

(Wiberg, 2010: 12).

As the above quote suggests, there is a strong relationship between transport and urban form. The car has allowed much greater distances to be travelled and as a result many urban areas have spread outwards (Banister, 2011; Newman & Kenworthy, 1999). Where this has been allowed to occur distances between homes, workplaces, shops, hospitals and schools have grown often making the car essential to efficient urban movement and undermining the ability of alternative transport modes to provide an effective service.

In his article "The trilogy of distance, speed and time" David Banister argues that the conventional transport "paradigm is heavily embedded in the belief that travel time needs to be minimised and consequentially speeds need to be increased" (Banister, 2011: 6). However, as distances grow this approach places great pressure on decision makers to increase the speed at which traffic flows in order to keep time delays within acceptable limits, with the result being a high speed, dangerous and poor quality urban environment. Moreover, facilitating high speed traffic flows simply encourages urban sprawl because it makes long distance travel workable. Shorter distances between locations would facilitate slower speeds and this is an important argument supporting the development of dense, compact, mixed use urban forms (Banister, 2011).

The process of urban sprawl has other ill-effects. We saw earlier how unsustainable urban forms can influence urban energy use and how it can make life difficult for the poor (as well as children, the disabled and the elderly). Continuing urban expansion/sprawl often wastefully consumes agricultural land, which may be extremely important for local food production in the future due to rising food and transportation costs (Crane & Swilling, 2008: 274).

Part of the problem is single use zoning and the spatial separation of work, home, education and leisure, as Urry (2004: 28) illustrates in the following quote:

"Automobility divides workplaces from homes, producing lengthy commutes into and across the city. It splits homes and business districts, undermining local retail outlets to which one might have walked or cycled, eroding town-centres, non-car pathways and public spaces. It separates homes and leisure sites often only available by motorized transport. Members of families are split up since they live in distant places involving complex travel to meet up even intermittently. People inhabit congestion, jams, temporal uncertainties and health threatening city environments, as a consequence of being encapsulated in a domestic, cocooned, moving capsule".

As I will explore later in this chapter, overcoming the problem will require the creation of dense, walkable urban villages connected by high quality public transport as a crucial strategy to enhancing urban resilience in the face of uncertain energy futures (Herala, 2003; Newman & Kenworthy, 1999). This allows for a reduction in the distances between places, which is crucial to the development of sustainable transport systems (Banister, 2011). As I will explore in Chapter 3, there are societies around the world implementing such measures.

2.4.7 Economics of car dominance

As is clear from the above quote the high dependence of some cities on cars does not provide any "obvious" economic advantages. Rather it has the potential to increase both public and private costs. Schiller *et al* argue that automobile dependent cities spend far more on "maintaining daily access to the needs of everyday life" (2010: 12) than those cities with high levels of public transport, cycling and walking. City income exits the local economy to pay for oil (Crane & Swilling, 2008: 279); the costs of operating a public transport system in a sprawling city are higher; and a vast and growing road network unnecessarily locks the public sector into decades of resource draining road maintenance (Kenworthy & Laube, 1999). In addition, Kenworthy (2006) argues that "central cities with strong traffic restraint are better-off economically than those with generous parking (Kenworthy, 2006: 77). McGranahan and Satterthwaite (2003) argue that CO_2 emissions from transport in Copenhagen and Amsterdam[1] are one third that of Detroit and Houston and many consider the former cities to have a superior quality of life.

Money spent on servicing the car could be used on other important urban priorities:

"The public savings in road construction and maintenance, traffic police, and hospital costs of people hurt in vehicle accidents or suffering from air pollution, can be used not only to provide excellent public transport, but also for schools, libraries, and parks, to mention only a few".

(Peñalosa, 2006: 9).

A comparison between the United States and Germany is indicative in this regard. American households spent on average $2, 712 per annum more on transport in 2003 than their German counterparts and, in 2006, per capita government spending on transport in Germany, at $460, was lower than that in the United States, at $625. In addition, public transport systems in the United States are subsidised by the state at a rate of 70% while in Germany the rate in only 30% (Buehler & Pucher, 2011: 46). This comparison reinforces the

[1] Both Copenhagen and Amsterdam have high levels of public transport use, walking and cycling. The car plays a significantly smaller role in their transport systems than it does in Detroit and Houston.

argument that countries with lower levels of car dependence, such as Germany, benefit economically and have a higher quality of life due to the existence of real alternatives to the car.

In addition, the high level of congestion that results from widespread car use is resulting in "large and growing economic costs" (Freund & Martin, 2007: 40). Particularly given the growing realisation that building ever larger freeways as a means of easing congestion is at best a temporary fix and at worst entirely useless (Kenworthy, 2007; UNEP, 2009). As Low & Gleeson (2001: 800) argue: "the limit of roads technology to achieve freedom of movement with tolerable fiscal and environmental burdens has been discovered".

Developing quality alternatives, particularly public transport, becomes an important measure to mitigate against the growing time delays and fuel costs that result from congestion. This is primarily because public transport is far more efficient at moving high numbers of people along high demand transport corridors than private cars (Vasconcellos, 2001; Parkhurst, 2003).

Moreover, as I argued earlier, rising oil prices may have a particularly harmful economic effect on cities with a high number of sprawling car-dependent suburbs. As Kenworthy (2007) speculates, "will low density suburbs be abandoned and perhaps be returned to farmland or natural areas because they are no longer able to function in transport terms" (Kenworthy, 2007: 63).

It is clear that an over-reliance on the car as the primary mode of urban transport comes at a significant social, environmental and economic cost with no significant economic benefits for the economy of the city.

The above overview of the social, environmental and economic effects of widespread car use suggests that a radically different approach to urban transport is required in order for more sustainable cities to become a reality. In the next section of this chapter, I will explore potential solutions to the problem of car dominance.

2.5 Sustainable Transport

I begin this section with a quote from the former mayor of Bogotá, Enrique Peñalosa, on the benefits of restricting car use in a developing county urban context:

"[T]he environmental implications in terms of noise, air pollution, energy consumption, and land use are significant. Socially, it would free immense resources currently devoted to care for roads mainly for the upper income citizens that could be used to invest in the needs of the poor; it would get all citizens together as equals regardless of income or social standing in public spaces, public transport or bicycles. And most importantly, it would allow cities to become a place primarily for people, a change from the last 80 years, a time during which cities were built much more for motor vehicles' mobility than for children's happiness".

(Peñalosa, 2006: 1).

A sustainable transport system is one which addresses the issues discussed in the previous sections of this chapter. Amongst other things it incorporates a concern for environmental integrity, social justice, economic vitality, urban resilience and the quality of urban life (Kenworthy, 2006, Schiller *et al*, 2010). Vasconcellos (2001) argues that in a developing

country the primary focus should be on the relationship between transport and inequality. Everyone should be able to move around the city effectively and affordably.

Schiller *et al* (2010: 3) provide the following definition of a sustainable transport system:

- *"Allows the basic access needs of individuals and societies to be met safely and in a manner consistent with human and ecosystem health, and with equity within and between generations"*

- *"Is affordable, operates efficiently, offers choice of transport mode and supports a vibrant economy"*

- *"Limits emissions and waste within the planet's ability to absorb them, minimises consumption of non-renewable resources, limits consumption of renewable resources to the sustainable yield level, reuses and recycles its components, and minimises the use of land and the production of noise"*

It is quite clear that the very few transport systems comply with these criteria for sustainability.

Peñalosa (2006) proposes a radically different model of urban transport in the developing world, one that involves "a severe restriction of automobile use" (Peñalosa, 2006: 1). He advocates banning car use during the peak hours of everyday and forcing all citizens to either walk, cycle or use public transport. He argues this will have hugely positive social and environmental effects on the city. While this may be politically unfeasible in many contexts it is the kind of idealistic vision which Mike Davis (2010) argues is necessary in a world where 'being realistic' is unlikely to resolve the multiple crises facing humanity.

The overriding focus of the sustainable transport approach is to limit the dominance of the car (Henderson, 2006; Kenworthy, 2006; Newman, 2007; Newman & Kenworthy, 1999; UNEP, 2009). According to the UNEP (2009: 19), "the number one, action-oriented policy for advancing with transport sustainability in cities remains the reduction of car use and the adverse impacts of motorisation". Newman (2007: 22) argues that "cities must plan and build to overcome car dependence" (Newman, 2007: 22), and Henderson (2006) makes a strong argument regarding the need to contest automobility:

"This contestation of automobility is about reclaiming urban spaces from automobiles, limiting their use, and more broadly, changing cultures so that the whole concept of high speed mobility and car ownership is de-emphasized".

(Henderson, 2006: 294).

It is highly problematic that rather than building to "overcome car dependence" many cities/towns continue to build in a way which supports a growing role for the car. Although, as we shall see in Chapter 3, this is not universally the case. Some cities are even beginning to remove freeways as they attempt to create more balanced and sustainable transport systems (Newman *et al*, 2009). Kenworthy & Laube (1999: 721) argue that:

"…international comparison suggests that increasing automobile dependence and declining transit and non-motorised mode use in cities are not inevitable. Rather, they appear to be responsive to public policy which seeks to minimise such trends through effective land use planning, transportation infrastructure and service delivery policies directed more towards

non-auto modes and through economic policies which set higher charges for auto ownership and use".

Newman & Kenworthy (1999: 144) emphasize the following five strategies which they believe should help to develop a sustainable transport system:

- *"Traffic calming – to slow auto traffic and create more urban, humane environments better suited to other transportation modes"*
- *"Quality transit , bicycling and walking – to provide genuine options to the car"*
- *"Urban villages – to create multimodal centres with mixed, dense land use that reduce the need to travel and that are linked to good transit"*
- *"Growth management – to prevent urban sprawl and redirect development into urban villages"*
- *"Taxing transportation better – to cover external costs and to use the revenues to help build a sustainable city based on the previous policies"*

Sustainable transport approaches emphasise an enhanced role for alternatives to the car including walking, cycling and public transport. These modes use little or no energy, have a much lower impact on the environment and are potentially accessible to all sectors of society (Aftabuzzaman & Mazloumi, 2011).

In addition, quality alternatives to the car and supportive urban forms facilitate greater social interaction, quality of life and active, healthy lifestyles (Farber and Paez, 2010).

Banister (2008) provides an overview of what he terms the 'sustainable mobility' approach:

"Empirical research has concluded that the key parameters of the sustainable city are that it should be over 25,000 population (preferably over 50,000), with medium densities (over 40 persons per hectare), with mixed use developments, and with preference given to developments in public transport accessible corridors and near to highly public transport accessible interchange".

(Banister, 2008:73 -74)

Banister goes on to argue that dense, public transport orientated centres should be linked to form polycentric urban forms. Within these centres the distance between every day facilities should be kept short so that walking and cycling are feasible alternatives. The ultimate intention, he argues, is to "design cities of such quality and at a suitable scale that people would not need to have a car" (Banister, 2008: 74). This is also known as transit orientated development, smart growth or concentrated deconcentration (Holden, 2004; UN-Habitat, 2010).

Cities with dense, mixed use, walkable layouts and quality public and non-motorised transport infrastructure facilitate the use of transport modes which consume less energy than cars and provide a more humane urban environment (UNEP, 2009). High density makes public transport more feasible and reduces the distance between locations. Table 2.3 below provides a comparison between Barcelona and Atlanta. It shows the huge variation in public transport access and use which occurs due, in part, to differences in density.

Table 2.3 Density and transport comparison: Atlanta and Barcelona

	Atlanta	Barcelona
Area (km²)	137	37
Population (millions, 1990)	2.5	2.8
Density (people per hectare)	6	171
Population close to metro	4% within 800m	60% within 600m
Trips undertaken by public transport	4.5%	30%

Source: Bertaud, 2004 in UN-Habitat, 2009

Research conducted by the city of Vancouver found that a "statistically significant positive link between higher densities and mixed uses, positive economic features and enhanced liveability, which suggests a three-way winning scenario for policies aimed at creating less auto-dependent living and more walkable and sociable environment" (Schiller *et al*, 2010: 269). This suggests that a more sustainable urban form can both enhance the quality of life and strengthen the economy of the city.

Critically, it is important to realise that a car friendly urban environment necessarily provides a poor quality walking and cycling experience. Sustainable transport requires that driving becomes increasingly inconvenient and costly in order to make cycling and walking more appealing. This demands a departure from the conventional transport paradigm where priority has been given to the car:

In particular, the dominant road safety objectives of traffic management, car-centric engineering standards of street layouts, and conventional designs of intersection controls can be a challenge to those seeking more sustainable solutions".

(Williams, 2005: 10).

Often, pedestrians face a constant series of obstacles and barriers as they move through the city. One example is side streets which constantly interrupt the path of a pedestrian and continually emphasise the priority of cars (Gehl & Gemzøe, 2006). Therefore, an emphasis on slower speeds and increased safety for non-motorised modes of transport is imperative:

"Designing for lower speeds, appropriate to the human context of streets and public spaces, is the most critical measure to restore the balance between people and vehicles. Interestingly, empirical evidence also suggests that journey times for vehicles improve at lower steady speeds, due to greater efficiencies at intersections".

(Hamilton-Baillie; 2008: 133).

Gehl & Gemzøe (2006) argue that there are many examples of cities and towns around the world which are contesting automobility by "reconquering" public spaces for people by finding a "workable balance between uses of the city as meeting place, marketplace and traffic space" (Gehl & Gemzøe, 2006: 14). However, it is easier to "reconquer" space in cities with good quality alternatives. In countries such as the U.S.A. and South Africa, the lack of viable alternatives complicates the implementation of car restrictive measures (Steg and Gifford, 2005). In such contexts radical car restrictive measures could undermine the urban economy. So, Parkhurst (2003: 16) argues "the fundamental question for city planners is whether (and how) the space can be reallocated to other functions without undermining the accessibility that enables the high-value urban economy to exist in the first place" (Parkhurst, 2003: 16). The key is to develop alternative means of access through public and

non-motorised transport and retrofitting cities so that most destinations can be reached using these modes (Newman & Kenworthy, 1999).

Facilitating a high level of public and non-motorised transport use is essential for the sustainable future of cities. It allows cities to enhance well-being while limiting the consumption of resources and the production of wastes. It also allows for rich and poor to have more equitable levels of access to urban opportunities and services. A radical transition towards a sustainable transport system is, therefore, essential for the realisation of resilient and sustainable cities. This necessarily requires a redistribution of scarce urban space away from the automobile to green modes.

In Chapter 3, I will explore urban areas that have successfully begun to move towards more sustainable transport systems by implementing innovative projects and policies which depart from the conventional, car-orientated approach to urban transport.

Despite the recognition that urban transport systems are unsustainable many countries, cities and towns have had difficulty shifting these systems onto a more sustainable path. Below, I will explore the barriers and obstacles preventing the transition to a more sustainable transport system.

2.6 Barriers to change

There are a multitude of barriers and obstacles to the transition from an unsustainable to a sustainable transport system. This includes both policy and resource constraints as well as deeper, systematic barriers to change. However, the two are connected, working together to sustain the unsustainable. In essence, it is the power and resilience of the "system of automobility" which dilutes any pressure for transition. This system, this regime, is composed of various elements including policies, infrastructures, institutions, attitudes, cultures, ways of life and economic investments which all support the continued existence of car dominated transport systems. The following quote by Geels & Kemp (2010) refers to the enduring strength of this system and the lack of pressure for change:

"[I]mportant regime actors are not (yet) fully committed to acknowledging these problems nor to placing them on agendas with a high sense of urgency. There is no broad debate about the need for transformative change. No powerful societal group is calling for it. Those who do are marginalized. Pressure for change in sustainable directions is therefore not great and currently not oriented towards large-scale systemic change".

(Geels & Kemp, 2010).

Moving towards a more sustainable transport system is by no means a simple process. There are a number of barriers to change including the strength of conventional transport planning paradigms, a lack of political will, limited resources and a lack of pressure for change. As we will see in Chapter 3, successful sustainable transport initiatives, where they have occurred, have often been reliant on progressive and strong political leadership, a capable local government and pressure from local communities for alternatives to car orientated urban trajectories (UN-Habitat, 2009):

"Major changes require well-coordinated and consistent policy implementation over a long period of time on infrastructure development, taxation and land-use regulation, and there are few cases where this has been possible – Curitiba (Brazil) being a notable exception".

(UN-Habitat, 2009: 159).

Buehler & Pucher provide an overview of the barriers and obstacles to transport system change from a policy perspective:

"Changes in transport and land use policies towards limiting car use and promoting more sustainable modes of transport often face barriers such as political and public acceptability, institutional inertia, splintered institutional responsibilities and lack of cooperation, financial constraints, municipal competition, legislative limitations, and public resistance to culture and lifestyle changes".

(Buehler & Pucher, 2011: 63).

As will become clear in Chapter 4, many of these are to be found in the case of Stellenbosch.

In a similar vein Banister (2005) argues that are a several 'barrier' categories to the implementation of sustainable transport measures including resource, institutional and policy, social cultural and legal barriers (Banister, 2005: 56). According to Banister (2005: 57), resource barriers are most often confronted, followed by institutional and policy barriers and then social and cultural barriers. A lack of human or financial resources (i.e. capacity) can impede any moves towards a more sustainable transport system. The process of change often requires a high level of capacity to implement a co-ordinated sustainable transport transition (Hodson & Marvin, 2010b; UN-Habitat, 2009).

Wright & Montezuma (2004:3) argue that "transforming the urban fabric of any city is a daunting task. The alignment of public support, political will, financial resources, and human capacity is a rare event". While, Nykvist & Whitmarsh (2008: 1376) argue that "car ownership is increasing and much of the resistance to change in the transport system may be attributed to deeply entrenched habits; for example, car use is often strongly influenced by habit. Furthermore, car ownership continues to be a facet of social status, and is often associated with having a good standard of living".

Evans *et al* (2001) suggest that current institutional culture and practice plays an important role in reproducing unsustainable patterns of development and therefore the transition to sustainable transport systems will require "cultural and institutional transformation" and the creation of "new institutional practices" including reducing the technocratic control of a policy making elite (Evans *et al*, 2001: 131). Similarly, Goldman & Gorham argue that a "radical reconfiguration of transport systems for sustainability" will require both "technological and institutional changes" (2008: 1374).

Kenworthy & Laube (1999) argue that the political will necessary to impose car restrictive policies is often lacking. While Goldman & Gorham (2006: 272) argues that the "key to sustainable transport will be leadership from political figures and policy professionals who have the optimism and vision to innovate, and the courage to learn from occasional failures" (Goldman & Gorham, 2006: 272). In addition, Schiller *et al* (2010) debate the important role of a politically active citizenry in pressing for more sustainable transport measures. The problem is that "transport is only one of a number of a number of major problems faced by the public" (Vasconcellos, 2001: 89) and in many developing country urban contexts political citizenship is weakly developed (Vasconcellos, 2001: 77).

The institutions, policies, habits and infrastructures which hinder transition do so by collectively reinforcing the existing unsustainable system. They serve to perpetuate a system which is ecological destructive, principally benefits the mobility of the middle class

and supports the power of the auto-industrial complex. The conventional transport paradigm is another powerful component of this system/regime, which aids in sustaining an unsustainable system.

2.6.1 The conventional transport paradigm

One of the most important barriers to transport system change is the conventional transport paradigm which has traditionally prioritised the mobility of the car. Low & Gleeson (2001) provide an insight into the power of transport decision makers in Australia to reproduce unsustainable transport systems:

"Continual major eruptions of public protest on the part of well-organized pressure groups at the destruction of local environments by roads, and the existence of well-considered alternatives have not overcome the countermodernizing barriers to change presented by the institutions of transport engineering in Australia".

(Low & Gleeson, 2001: 800).

In the past it was standard practice to prioritise the car and its free flowing mobility. Public authorities focused their efforts on reducing congestion and its negative economic impact (Mercier & Laval, 2009). Yet, in developing countries, they often ignored the dire socio-economic effects that result from the constrained mobility experienced by the poor majority in a city designed for the car which, Baeten (2000) argues, should be their primary concern. Peñalosa makes the following argument in this regard:

"Do we dare create a transport system giving priority to the needs of the poor majority rather than the automobile owning minority? Are we trying to find the most efficient, economical way to move a city's population, as cleanly and as comfortably as possible? Or are we just trying to minimise the upper class's traffic jams?"

(Peñalosa, 2006: 4).

A growing awareness that the conventional approach is deeply problematic has given rise to alternative, more sustainable approaches which recognise environmental and equity issues (Low & Gleeson, 2001).

In addition, Kenworthy (2007) argues that efforts to reduce congestion and improve vehicle flow are detrimental to the development of a sustainable transport system:

"Overall, the results suggest that rather than saving energy, reducing congestion increases energy use. Higher traffic speeds favor cars, increase urban sprawl and travel distances, and reduce the viability of other modes. Speed is not used to save time; it is used to travel further".

He goes on to argue that congestion can be an incentive to use sustainable modes of transport (if these alternatives exist) by acting as a "brake on car use" (Kenworthy, 2007: 58). It also helps to improve the speed advantage of public transport over the private car (Kenworthy, 2007). Therefore, Kenworthy advocates "dropping congestion relief programs and recognizing that congestion can help cities reduce car use and energy consumption" (Kenworthy, 2007: 47). Similarly, Peñalosa (2006: 6) argues that "building new road infrastructure in order to solve traffic problems is not only regressive and dehumanizes a city, but it is also useless".

The role of conventional street design in perpetuating car dominance is also important. Litman (2002: 61 in Freund & Martin, 2007: 40) argues that:

"Current street design and funding practices tend to emphasize motor vehicle needs at the expense of other users. Specific design features that benefit drivers at the expense of other users include hierarchical street networks, wide lanes, straight alignments, smooth surfaces, large turning radii, synchronized traffic signals, and maximum surface parking. Because of limited resources, accommodating motor vehicle traffic often reduces the size and quality of sidewalks, bikeways and other facilities for non-motorized users".

It seems clear that design matters and the way in which the urban environment, and particularly roads, are designed aids in the perpetuation of car dominance. Increasingly, it is being argued that significantly reducing the speed of traffic is one of the most important aspects of a sustainable transport policy (Banister, 2008; Banister, 2011; Hamilton-Baillie, 2008; Newman & Kenworthy, 1999). This, however, contradicts conventional transport practice which aims to maintain flows of traffic and save time by increasing speeds (Banister, 2011). It is possible to design streets in ways which encourage the use of sustainable modes of transport but this requires transcending the conventional transport paradigm as Hamilton-Baillie argues:

"At a local level, clear and determined political leadership is required to question the orthodoxies that have given us such poor streetscapes, and to provide the encouragement and protection to officers prepared to innovate and introduce best practice from elsewhere.
(Hamilton-Baillie, 2008: 137).

While agents of the conventional transport paradigm serve to reinforce car dominance, other professions, such as urban design, are often more supportive of a more humane, equitable and balanced urban environment. As a result conflict between different socio-technical approaches emerges. This is an important area in which automobility in contested and is worthy of exploration below.

2.6.2 Contradictory socio-technical approaches

The fragmented and, often, contradictory approaches of the professionals involved in the design of the urban environment also presents a barrier to transport system change. In specific reference to the South African context, Wilkinson (2002: 7/8) argues that the differing approaches of these professionals are not easily resolved within local government structures. Hamilton-Baillie (2008: 137) makes a similar argument:

"To overcome the gulf that exists between traffic engineering and the design professions organisational, cultural and educational change is required. Almost all local authorities currently separate the two activities into distinct departments, usually in different buildings, and often into different levels of government. Responsibility for streets is usually fragmented among 20–30 separate agencies, rarely with any overall coordination".
(Hamilton-Baillie, 2008: 137).

Banister (2011) argues that greater public involvement in decision-making is vital to overcome to this problem and to achieve more sustainable outcomes:

It is only through these social processes that the potential conflicts between the engineers (building roads), urban designers (use of space), planners (arbiters), and the local communities (self and collective interests) can be resolved".

(Banister, 2011: 5).

As I have argued throughout this chapter, the "system of automobility" is maintained by a complex set of interrelated components. The strength of the conventional transport paradigm, often expressed at a local level through standard traffic engineering practice, is one such component. As I've shown in this section, other professions often contest the car-centric conventional approach. This is one element of a broader wave of contestation required to ensure the transition to a more sustainable system, as I will discuss below.

2.6.3 Contested urban futures

It is important to bear in mind the contested nature of the transition towards sustainability (Pieterse, 2008). There are multiple "competing ideas and visions" (Evans *et al*, 2001: 122) about the future of transport systems. Guy & Marvin (1999) argue that "different actor groups within a single locality interpret sustainability in different ways, holding very different opinions as to how technical networks should be managed more sustainably in the future" (Guy & Marvin, 1999: 271). Rich, poor, planners, engineers, academics and politicians all have different ideas and visions of what a sustainable city is and how it should be achieved. Some of these ideas may be conducive towards the development of a "socially just and ecologically sustainable world", others may not.

As I have argued before, car dominated urban transport systems favour certain groups within society, most notably the middle class (Vasconcellos, 2001). If a more sustainable transport system is to become a reality then the dominance of the car and the notion that widespread car use is inevitable must be challenged (Henderson, 2006; Low & Gleeson, 2001). Peñalosa (2006) argues that severe car restrictions would dramatically improve the quality of urban life for the majority of residents in a developing city, including the middle class, but the fact that they are not imposed is "yet more evidence that the priorities of the political and economic systems are not to solve the needs of the poor, or even to benefit the majority of the population, but rather to favour the ruling upper income groups" (Peñalosa, 2006: 8). Pressure from the car driving middle class is primarily directed towards congestion reduction and additional parking facilities (Vasconcellos, 2001). The power of dominant groups to guide urban development in a direction that benefits them is great, as Chatterton (2010: 236) argues below:

"Individuals, groups and coalitions often with very different values strive to intervene, improve and determine their futures. Of course, while many people are involved in shaping the city, some are more successful (and powerful) than others. While some visions succeed, others wither or are shelved, while some are viciously oppressed".

It is clear that in many cases the "more successful" elite have, indeed, succeeded in shaping the city for their benefit. However, Chatterton (2010) argues that the city is constantly reshaping itself in countless different ways and "new possibilities for radically different cities" (Chatterton, 2010: 236) are often present:

"Amongst this infrastructure lay the seeds of countless possible urban futures. Each needs different political wills, commitments, resources, forms of organising and institutions. Each is as possible as the next. The unfinished city, then, constantly has properties that are

emergent, in a process of becoming and it is in these spaces of emergence that innovation and new models for change flourish"

(Chatterton, 2010: 237).

What Chatterton is describing is the process of socio-technical innovation, which I will explore in the next section of this chapter. The connected processes of innovation and contestation are key to the transition to a sustainable transport system.

In order to transcend the conventional transport paradigm and allow innovative, sustainable transport systems to emerge, unsustainable transport systems, values, institutions and practice must be contested. An important reason for continued urban inequality, poverty and ecological deterioration is the failure of "urban actors who are interested in and committed to economic justice to find their voice and drive systematic reforms" (Pieterse, 2008: 37). Pieterse (2008) argues that the poor (and those who seek an egalitarian urban future) must actively contest the process of urban development to ensure more egalitarian outcomes by strategically exerting pressure at multiple sites of political contestation and decision making. Like Chatterton (2010), Pieterse argues that the dynamic, ever-changing nature of the city means that power networks are permeable and multiple processes of contestation may eventually gain traction and generate radical city transformation. Therefore, the transition toward a sustainable transport system can be strengthened and guided in the direction of sustainability by active and eclectic means of strategic political contestation by those with an interest in a more equitable and ecologically sound transport system (Pieterse, 2008). There is a relationship between this approach and the role of innovation. Innovation is a form of contestation as it involves activities which depart from the dominant paradigm. As Chatterton argued above, such innovations contain the seeds of potential sustainable urban futures. This will be explored further in the next section.

Earlier in this chapter I discussed the difficulty involved in transitioning towards a more sustainable transport system given the entrenched nature of the "system of automobility" and its seemingly unstoppable global expansion (Freund & Martin, 2007; Urry, 2004). However, as the unsustainability of the dominant urban transport paradigm becomes ever more apparent it is likely that the pressure for change will increase, especially as oil prices edge ever higher (Newman, 2007; Nykvist & Whitmarsh, 2008). In reference to the situation in China, Martin (2006: 71) argues that the development of a sustainable transport system ultimately depends on the willingness of "authorities to leash motorization in favour of social and transport justice, environmental integrity and public health". He goes on to argue that "such a leashing" is only likely to occur due to internal pressures as a result of the growing "socioecological problems" of rapidly increasing motorization (Martin, 2006: 71). Similarly, Freund & Martin (2007) argue that "critical transport decisions" are being made in developing countries, like South Africa, "that will have major impacts on the lives of their citizens as well as upon global environmental integrity" (Freund & Martin, 2007: 47). Sustainable development requires that these decisions support an urban future which is socially just and ecologically sustainable (Gallopin, 2003).

2.7 Urban Socio-Technical Transition

"*[Alternatives to the car have] captured only a very small fraction of the market, with the car (including SUVs and vans) continuing to be the preferred solution for personal mobility. This is no surprise if we take into account the entrenchment of the car system".*

(Vergragt, 2006: 15).

A method of analysing a transport system and the dynamics of change, or the lack therefore, is the transition approach. It allows one to examine the pressures for change, the institutions and practices which prevent or support change and the innovative solutions to the problems of local and global unsustainability.

The unsustainable nature of the dominant urban transport model suggests that a radical transition towards a more sustainable system is required. A transition is defined as:

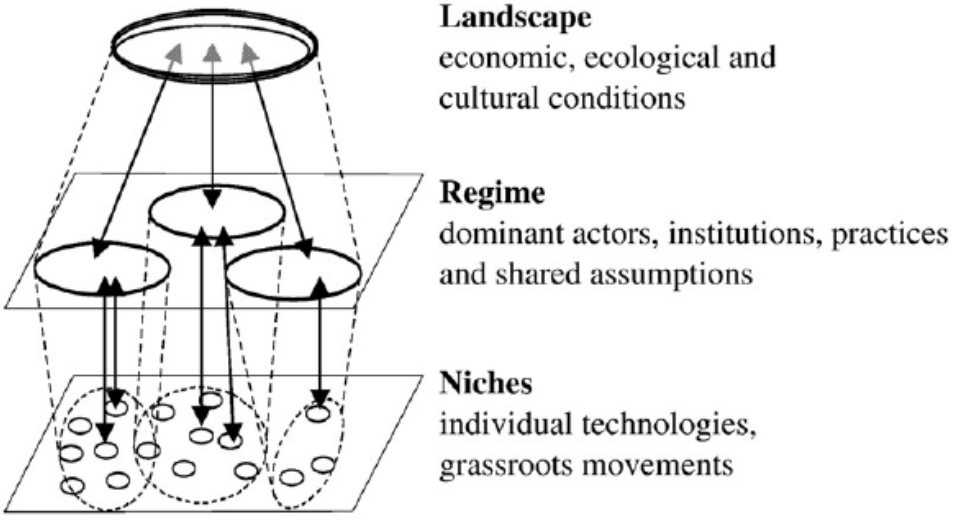
"[L]ong-term, continuous processes in which a society or a subsystem changes fundamentally -interconnected changes that reinforce each other in technology, the economy, institutions, ecology, culture, behaviour and belief systems".

(Vergragt, 2004: 13)

Schiller *et al* argue that "most of the advances we would characterize under the rubric of ST (sustainable transport) seem to be occurring at the city and urban-area levels of society. Larger social and governmental units seem to be having greater difficulty in charting and maintaining the course of ST" (Schiller *et al*, (2010: 221). The *urban* transition towards sustainable transport would therefore appear to be a crucial area of investigation.

The transitions approach makes use of a multi-level perspective (MLP) (see Figure 2.3 below). These multi-levels being the landscape, the regime and the niche which interact in processes of "co-evolution and mutual adaptation" (Shove & Walker, 2007). The landscape refers to the "the broader 'conditions', 'environment' and 'pressures' for transition (Hodson & Marvin, 2010a: 479). The regime consists of the dominant "culture, structure and practices" (Nykvist & Whitmarsh, 2008: 1374) governing a socio-technical system. Urban socio-technical regimes are, in most cases, stable and resist the radical change necessary to address pressing issues. If change occurs it is incremental. The "system of automobility" is an example of a socio-technical regime as is its local expression in the urban institutions, policies, attitudes and ways of life which perpetuate car dominance.

Figure 2.3 The multi-level perspective



The multi-level perspective (Geels, 2002 in Nykvist & Whitmarsh, 2008)

Some MLP approaches place an emphasis on the vital role of the niche and innovation in the process of transition. According to the UNEP (2011) innovations are "continuous learning processes that are necessary in a highly complex globalized world where fixed bits of knowledge rapidly become obsolete" (UNEP, 2011: 36). Socio-technical niches are protected spaces of innovation where "norms and practices are developed which depart from those of an incumbent technological regime" (Berkhout *et al*, 2004: 48).

According to Nykvist & Whitmarsh (2008: 1374) a "niche can comprise of new technologies, institutions, markets, lifestyles and cultural elements and consists of networks of actors/organisations". Socio-technical regime change occurs when "practices and norms developed in the niche become adopted more widely" (Berkhout *et al*, 2004: 48). Niche innovations can be supported by, for example, "providing them with knowledge and removing barriers" (Kemp & Rotmans, 2008: 1007). Under the right circumstances, strengthening niche innovations increases the chance that they can break through and become dominant (Kemp & Rotmans, 2008). Niche activity is not limited to technological innovations but can also include "innovation in policy instruments, new functionalities, and innovative use of existing technologies" (Nykvist & Whitmarsh, 2008: 1375). The implications for governing transitions are that niche innovations need to be supported and allowed to flourish in order to support socio-technical transition (Tukker & Butter, 2007). The source and location of resources necessary to support innovation is important. Governing transitions will require a co-ordination of these resources in the pursuit of purposive socio-technical transition (Berkhout, *et al*, 2004; Hodson & Marvin, 2010a).

Others argue that transitions can follow many different pathways and that niche innovations are only one possible means of transition (Berkhout *et al*, 2004; Hodson & Marvin, 2010a; Tukker & Butter, 2007). Berkhout *et al* argue that "each transition displays unique characteristics, dynamics and history" (Berkhout *et al*, 2004: 53). For example, they argue, transitions can often be initiated primarily due to strong landscape pressures which induce innovation within a regime (top-down as opposed to niche induced bottom-up transition). The kind of response generated by pressure is dependent on the unique characteristics of the particular regime concerned. They go on to argue that socio-technical transition has often been successfully pursued by actively undermining the dominant regime rather than trying to build up alternatives in niches (Berkhout *et al*, 2004: 61). In addition the authors argue that drivers of change can emerge from "within and beyond the socio-technical regime" (Berkhout *et al*, 2004: 62). So the point is that transitions can occur in different ways and that the context in which transitions occur is important. This research will attempt to gain an understanding of the situation/context in Stellenbosch from the perspective of transition theory by identifying the pressures for and barriers to change and the scope for transition given this context.

Again, it is important to bear in mind the contested nature of transitions and to recognise the "contending interests embodied in competing socio-technical regimes" (Berkhout *et al*, 2004: 58). This is of particular importance in the transport sector of a developing country where re-orientating a transport system towards sustainable modes is a reverse of the regressive priority given to the car at present (Vasconcellos, 2001). The technocratic way in which transport decision making if often approached disguises the deeply problematic impact the results of this decision making have for the poor and the environment. When analysing decision making for sustainability, Berkhout *et al* argue for "the importance of being explicit about what is being sustained, for whom it is being sustained, and why is should be sustained" (Berkhout *et al*, 2004: 59).

Hodson & Marvin (2010a) provide some idea of the growing pressures cities are facing around the world and the transitions that this is eliciting. They argue that cities are beginning to experience landscape pressures to respond to issues such as climate change and growing resource insecurity in order to ensure their continued economic and social reproduction. Similarly Nykvist & Whitmarsh (2008: 1376) argue that "environmental problems – notably climate change, air pollution, and resource depletion – are emerging as landscape changes that encourage actors to seek more radical mobility solutions".

The ability of cities to respond to landscape pressures is limited by the extent to which they are able to reshape urban infrastructure, which is often controlled and influenced by a multitude of different actors, institutions etc. who possess a multitude of different "viewpoints and positions" (Hodson & Marvin, 2010: 478) with regards to the transition. Therefore Hodson & Marvin (2010: 478) argue that "'effective' responses to these pressures are thus predicated on multiple challenges, multiple actors and multiple levels that require effective coordination to inform control of infrastructure systems". This approach suggests that successful socio-technical transition within the town of Stellenbosch will require a capacity to effectively co-ordinate the various actors within the transport system in the purposive pursuit of a sustainable transport future.

Within the transport sector there are a number of innovations which may be vital to the development of a more sustainable transport system. Many of these will be examined in Chapter 3. Nykvist & Whitmarsh (2008) argue that three broad areas of innovation with the transport sector are emerging in the UK and Sweden. This includes "radical vehicle technologies, product-to-service shift and mobility management" (Nykvist & Whitmarsh, 2008: 1379). The authors define mobility management as:

"[A] more 'local and green' way of living with lower overall transport demand and resource consumption as a result of changes in values of quality of life and widespread institutional change. This niche includes: a positive development of slow-modes (walking and cycling); utilisation of ICT replacing transport demand and demand management policies such as congestion and road pricing".

(Nykvist & Whitmarsh, 2008: 1379).

In addition, Goldman & Gorham (2006) provide an overview of the innovations occurring within the transport sector which include initiatives as diverse as bike sharing schemes, shared streets, alternative fuels, intelligent transport systems, car sharing, car free neighbourhoods, integrated ticketing, congestion charging and pedestrian realms (Goldman & Gorham, 2006). The authors suggest that these innovating schemes may hold the key to a sustainable transport future as conventional approaches to transport are replaced. Similarly, Urry (2004: 33) argues that:

"Current thinking about automobility is characterized by linear thinking: can existing cars be given a technical fix to decrease fuel consumption or can existing public transport be improved a bit? But the real challenge is how to move to a different pattern involving a more or less complete break with the current car system. The current car-system could not be disrupted by linear changes but only by a set of interdependent changes occurring in a certain order that might move, or tip, the system into a new path".

In other words multiple innovations contesting automobility, driven by a desire to create an equitable and ecologically balanced world, is key to inducing the transition to more sustainable urban transport systems. As I have argued before, the "system of automobility"

is multifaceted and therefore multifaceted innovation in policy, infrastructure, everyday life etc. is required to contest the dominant regime.

Transition theory provides an important perspective on the problem of unsustainable transport and enhances our understanding of the dynamics of entrenched regimes and the possibility for innovation and transition. From this perspective, encouraging innovative approaches to urban transport is important for the emergence of a more sustainable urban transport system, which consumes fewer resources, produces less waste, is respectful of ecological limits and promotes social equity.

2.8 Conclusion

It is clear that the dominant approach to urban transport is unsustainable. The multiple ways in which transport and, particularly, the car undermine social, environmental and economic systems (the socio-ecological system) suggests that radical change in necessary for a sustainable transport system to become a reality. However, despite a growing recognition that change is necessary, car dominated urban transport systems have proved to be extraordinarily stable and unchanging (Urry, 2004). There are numerous barriers preventing a transition to a more sustainable transport system, none more important than the deeply entrenched "system of automobility".

Transition theory provides a useful perspective on the issue of unsustainable transport and transport system change by helping to explain the entrenched nature of the current system, the pressures for change and the ways in which change could, potentially, be achieved. The role of innovation is central in this regard:

"The key to decoupling in practice will be sustainability-oriented innovations that make it possible to increase resource productivity, thereby reducing metabolic rates".

(UNEP, 2011: 36).

In developing countries, it is particularly important for car dominance to be contested and for cities to be reshaped so as to encourage modes of transport which support egalitarian and ecologically balanced societies.

Sustainability-orientated transport innovations have taken place around the world. Some cities, like Copenhagen and Davis, have embraced innovative approaches for some time. Others, such as New York, have only recently begun to embrace transport innovations for a sustainable future. So despite the power of the global "system of automobility" and its complex web of reinforcing elements, innovations which depart from automobility and contest its perpetuation have emerged throughout the world. Power is never absolute, space for alternative approaches is often present and as such alternatives can emerge, which over time can strengthen, reinforce each other and, potentially, induce transition (Pieterse, 2008; Chatterton, 2011). This is the subject of the next chapter.

3. Case Studies

3.1 Introduction

There are towns and cities around the world, in both rich and poor countries, which have recognised the problematic nature of car-orientated urban transport system (Low & Gleeson, 2001). In response, they have sought to develop a more sustainable approach to urban transport by embracing alternative, innovative initiatives. A brief review of their policies, programmes and achievements is essential in order to form an idea of what is possible despite the barriers described in Chapter 2, in particular the power and resilience of the "system of automobility". The town of Stellenbosch can draw lessons from the experience of these towns and cities. It is impossible, given the limited space available, to review all the cases of sustainable transport from around the world. Therefore, I have chosen a group of towns/cities which offer important lessons to Stellenbosch. These examples appear frequently in the sustainable transport literature as exemplars of sustainable transport practice (Schiller *et al*, 2010; Newman *et al*, 2009; Newman & Kenworthy, 1999; UNEP, 2009). It includes:

- New York City, United States
- Davis, United States
- Copenhagen, Denmark
- Freiburg, Germany
- Curitiba, Brazil
- Bogotá, Columbia
- Guangzhou, China

These cases are drawn from both the developed and the developing world. To different degrees, the cases from the developing world, illustrate that economic prosperity does not have to occur in concert with unbridled car use. Therefore, it is possible for urban areas which are still developing (such as Stellenbosch) to take steps to restrain car use and its negative effects (as discussed in Chapter 2). The cases drawn from the developing world show how developing countries can limit car dominance and in some cases (Curitiba) lead the world in urban transport innovations.

Table 3.1, below, given an overview of the trip distribution figures for different regions of the world. It provides an insight in to the differences that exist globally. As I discussed in Chapter 2, high levels of non-motorised and public transport, i.e. green modes of transport, are important facets of a sustainable transport system.

Table 3.1 Comparative modal split for daily trips

	Africa	Western Europe	United States	China
Proportion of daily trips by non-motorized modes	41.4%	31.4%	8.1%	65%
Proportion of daily trips by motorized public modes	26.3%	19%	3.4%	19%
Proportion of daily trips by motorized private modes	32.3%	49.7%	88.5%	15.9%

Source: Kenworthy & Laube, 2001.

Locally, the modal split for commuter trips in Cape Town can be seen below in Table 3.2.

Table 3.2 Commuter modal split in Cape Town

Private transport	Public transport	Non-motorised transport
48%	33%	13%

Source: City of Cape Town, 2006 in Behrens & Wilkinson, 2008.

Achieving high levels of public and non-motorised transport use in wealthy cities is of particular interest because it suggests that economic prosperity does not have to occur in conjunction with uncontrolled car use. Despite generally high levels of car ownership in these urban areas, many residents choose to use alternative modes of transport to move around. For example in Groningen (The Netherlands) nearly 50% of all trips are made by bicycle (Bratzel, 1999). In Zurich (Switzerland) car use makes up only 28% of daily trips, far lower than the Western European average of 49.7% (Kenworthy & Laube, 2001). In some European cities, Basle (Switzerland) for example, it is not only car use but also car ownership which is substantially lower than the norm, due, in part, to the existence of quality alternatives to the car (Bratzel, 1999). Table 3.3 below shows the modal split for a number of cities in Western Europe which are considered to have relatively sustainable transport systems (these figures are from 1990).

Table 3.3 Comparative European modal split

	Zurich	Amsterdam	Groningen	Freiburg
Car	28%	31%	36%	42%
Public transport	37%	23%	6%	18%
Non-motorised transport	35%	46%	65%	40%

Source: Bratzel, 1999.

The modal split in developing countries is often in favour of green modes i.e. public and non-motorised transport (see the figures for Africa and China in Table 3.1). This is primarily because the majority of people in these regions cannot afford to drive cars. As a result, the contribution of these countries to global energy consumption and pollution production in the transport sector is relatively low on a per capita basis. The challenge for these countries is to achieve development but to retain the use of green modes in order to avoid a future of automobile dependence and the associated problems, as explored in chapter 2. This requires moving away from the conventional transport approach of structuring urban environments primarily in favour of the car. Rather the focus should shift to enhancing

public transport, walking and cycling and the urban forms/street design which support these modes.

In this Chapter, I explore sustainable transport initiatives in a number of towns/cities around the world in order to gain an understanding of what is possible. Some have incrementally transformed their transport systems over several decades and others have made very rapid change in a short space of time. As I discussed in Chapter 2, the transition to sustainable transport systems is far from easy (Wright & Montezuma, 2004).

The places described below are those which have successfully been able to achieve such an alignment and, as a result, have implemented innovative sustainable transport measures.

3.2 New York City (United States of America)

In recent times, New York City (NYC) has developed a strong, visionary approach to issues of sustainable transport. What is remarkable about NYC is the extent of the change that has occurred in a very short space of time. The city has implemented a series of policies and projects designed to create a more liveable and sustainable city with the focus on:

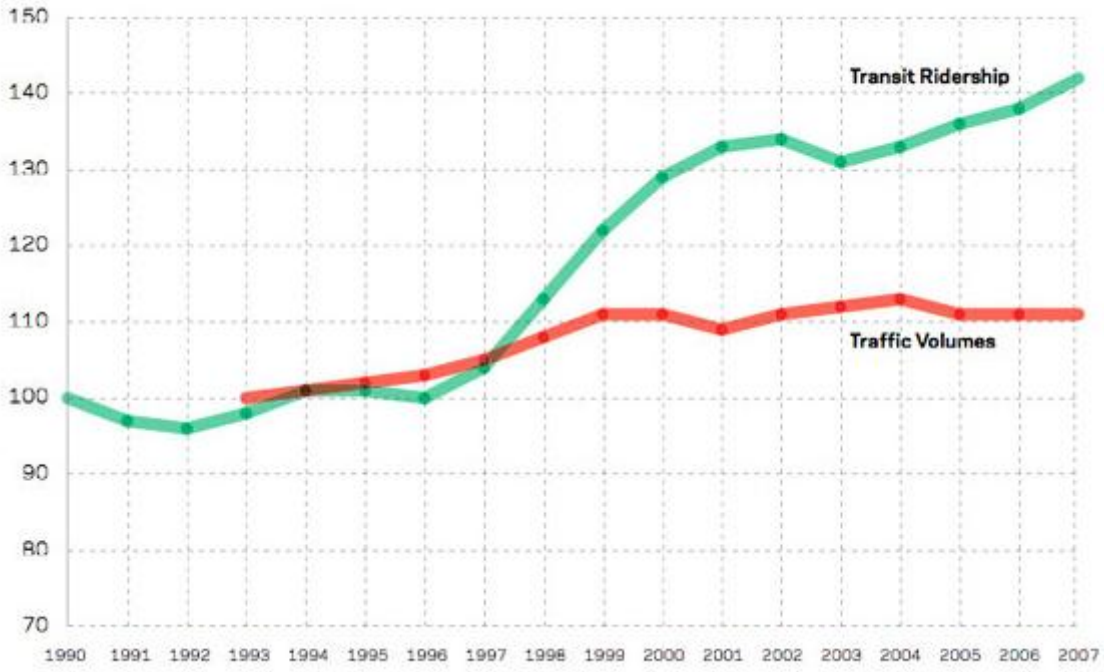
- Transit orientated, mixed use, mixed income development
- Safer, better streets to encourage walking and cycling and
- Significant increases in quality public space

New York City has a number of attributes which its planners and decision makers have sought to capitalise on in order to secure a sustainable future for the city (Pucher *et al*, 2010). NYC has an extensive transit system and is characterised by high density, mixed use development. The city has the highest use of transit to work in the United States, standing at 55%. Per capita energy and CO_2 emissions in the city are one-third that of the average American. Newman *et al* (2009) argue that New York is the best placed city in the United States to deal with peak oil. Fuel use is relatively low due the city's "density and transit base" coupled with the fact that more than 50% of the city's residents do not own a car (Newman *et al*, 2009: 88). It is highly significant that between 2003 and 2007 the level of private vehicle traffic remained flat while public transport managed to absorb rising levels of travel (see Figure 3.1 below) during a period when the city gained 130,000 additional residents and 200, 000 more jobs (Fried, 2010). This is partially because the city's roads are saturated during peak hours but, again it indicates that growth does not always occur in conjunction with rising traffic levels.

Bicycle use in the city is comparatively low. "Traditionally…the streets have been designed primarily for motor vehicle traffic" (New York City Department of Transport, 2008: 11) with the result being unsafe conditions for walking and cycling.

In recent years a significant transformation has been occurring driven, in part, by the city's long term sustainability strategy: PlaNYC: 2030 (Goodyear, 2011).

Figure 3.1 New York City transport trends 1990 - 2007



Source: Fried, 2010.

Nowhere is this change more apparent than in the realm of cycling. Between 1997 and 2009, the city's cycle network increased by 500% to reach a total of 900 km (561 miles) in January 2009 (Pucher *et al*, 2010). Between 2006 and 2009 the city installed an additional 300km of additional bicycle paths (Pucher *et al*, 2010). The city aims to install a total of 2880km by 2030. In addition, the city installed 3000 new bike racks in the six years between 2001 and 2007 with a total of 6100 racks by 2009 (Pucher *et al*, 2010). The "bike share of total work commuters" doubled from 0.3% in 1990 to 0.6% in 2008 (Pucher *et al*, 2010: 4). Between 2000 and 2007 cycling increased by 116% (New York City Department of Transportation, 2007 in Pucher and Buehler, 2008: 524) and between 2000 and 2008 injuries to cyclists declined by 50% (Sadik-Khan, 2011). In 2008 alone, cycling commutes increased by 35%. Figure 3.2 below shows 9th Avenue before and after it was redesigned to make walking and cycling safer. This is known as a 'complete street' because it caters for all modes of transport in a more balanced way. The city has provided several physically separated bicycle lanes on arterial roads, like those on 9th avenue, giving the cyclist a greater sense of security.

Many of the very recent transport improvements in New York City have been attributed to the city's current transport commissioner, Janette Sadik-Kahn, who was appointed in 2007. She has emphasised "giving primacy to people over cars" (Goodyear, 2011) and has been supported by the city's mayor, Michael Bloomberg, most notably in the case of the controversial pedestrianisation of Times Square.

Figure 3.2 Conversion of 9th Avenue

Source: Ruso et al; New York City Department of Transport.

Under her leadership, the city's Department of Transport has taken innovative steps to give sustainable modes of transport priority. Some of the standout projects include:

- The development of quality urban public areas by 'reconquering' space from the car often with limited heavy construction and minimal expense (see Figure 3.3 below). The 'Plaza Program' sees temporary public spaces created by the simple use of paint, planters and public seating, with permanent upgrades done at a later date if the project is successful (Sadik-Khan, 2011). Times Square was pedestrianised with hugely beneficial results for surrounding businesses with retail rentals rising by 71% post-pedestrianisation. Sadik-Khan explains:

"We are looking at our streets differently, and treating them as the valuable public spaces that they are. With 6,000 miles of streets, that's a lot of real estate to work with. We're looking to create world-class streets that work better for everyone who uses them, and are more inviting… I look at it as balance. About a third of New Yorkers walk, about a third of New Yorkers take transit, and about a third of New Yorkers drive. We haven't allocated our street space accordingly."

(Goodyear, 2011).

The city's public plaza program sees non-profit organisations compete for city funding for the creation of neighbourhood public space on underused sections of road. The plazas are then maintained and managed in partnership with local community groups (New York City, 2011)

- Inspired by Bogotá, a Summer Streets programme was initiated in which Park Avenue is closed to car traffic three Saturdays every summer so it can be used for recreational purposes. In 2008 and 2009 100, 000 people made use of the summer streets (Sadik-Khan, 2011; Pucher *et al*, 2010).

- There has been a strong emphasis on providing seating throughout the city guided by the belief that it is one of the simplest and most effective means of encouraging walking and the use of public spaces (Sadik-Khan, 2011). Figure 3.3 below is an example of a simple public space upgrade:

Figure 3.3 A new public space

Source: Sadik-Khan, 2011.

- Safety for pedestrians and cyclists is one is a highest priorities for the transport commissioner. 2009 and 2010 recorded the lowest traffic fatalities on record (Sadik-Kahn, 2011). Sadik-Khan argues that:

"I think it is key to understand that sustainable transportation means safe streets, because you can't get people to bike or to walk unless they feel safe doing so".

(Janette Sadik-Kahn, 2011).

The city recently announced the development of its first slow zone project, in which speeds are restricted to 20 mph. This is similar to the 400 highly successful slow zones implemented in London. These zones are designed to slow traffic in order to make cycling and walking safer and enhance the quality of the urban environment. (Kazis, 2011).

Janet Sadik-Kahn argues that cities striving to follow the example of New York should be bold and be aware that change can be made even with limited resources:

"I think that's why the New York example has resonated around the country and around the world. In the last three years, we've transformed some really important parts of the city, not spending very much money at all".

(Goodyear, 2011).

The efforts of the transport department have been supported by land-use planning in the city. Planners in New York have placed a strong emphasis on transit orientated development. They conducted a massive rezoning exercise in order to channel mixed use development to areas with access to transit. Currently 87% of development permits are within a ten minute walk of a subway station. The goal is for this to rise to 95% by 2030. Development has been frozen in car-orientated suburban areas which lack access to transit systems primarily because the road network simply cannot handle the increased traffic that would result if such development were to occur (Burden, 2011). Clearly, there is a strong emphasis on the relationship between transport and land-use planning and how this is central to creating a sustainable city. A few examples of the innovative approach of planners include:

- An incentive based scheme has been developed in which housing project developers get a floor area bonus of 30% in exchange for providing 20% accommodation to low income residents.

- A similar floor space bonus is created for developers in Manhattan that create public space

- Zoning regulations now require all new developments to include secure bicycle parking. This includes "universities, hospitals, residences and office spaces" (Burden, 2011).

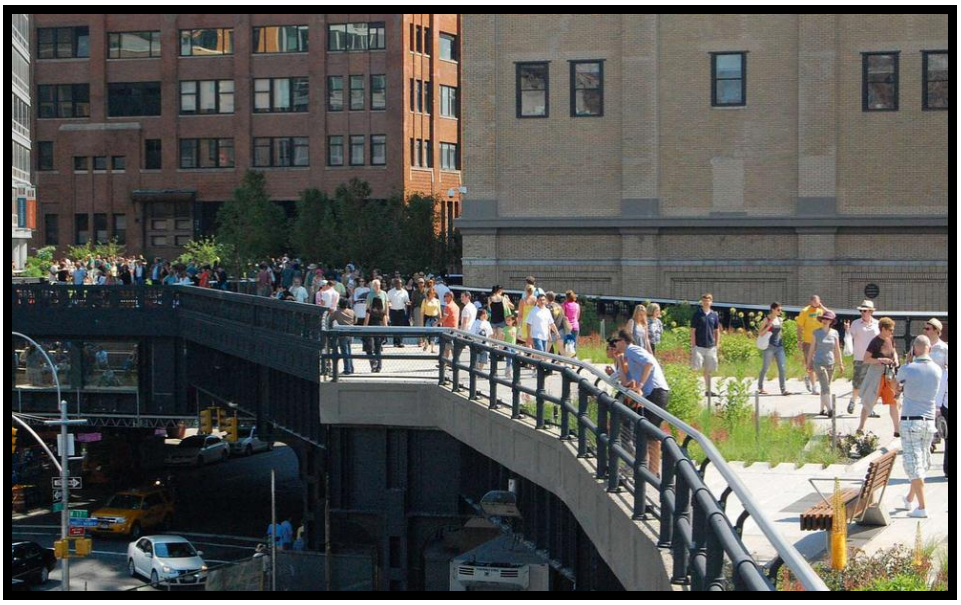
The approach, mentioned above, to bicycle parking is an example of a simple way in which land use and transport planning concerns can interact. Freiburg, in Germany, has a similar policy.

Additionally, the city has also converted an abandoned rail track, the High Line, into a public park and walking space which will eventually run for 1.5 miles (see figure 3.4). Phase 2 of this project opened recently.

The approach by New York City to transport and planning has clearly taken on board the tenets of sustainable transport. However, these projects are not without their opponents

and there has recently been a growing level of controversy especially with regards to bicycle lanes (Shaer, 2011). This serves as a reminder that transport is deeply political. It revolves around the distribution of scarce urban space for competing purposes. New York has a history of prioritising space for the car. Of late this has been changing and resistance is inevitable (Shaer, 2011).

Figure 3.4 The Highline



Source: highline.org

New York City has shown that it is possible, within a relatively short space of time, to rapidly change and reconquer space from the car in order to enhance the quality of urban life. From a cycling perspective, Pucher *et al* (2010) argue that the city still has a long way to go. The main obstacle to cycling is the heavy traffic found in New York. The authors argue that the city can learn from the success of cycling in the European context by implementing similar measures including "reducing overall motor vehicle speeds, removing car parking, traffic calming residential neighbourhood streets, and providing physically separated bike lanes and paths along arterials" (Pucher *et al*, 2010: 47). Implementing such measures will not, however, be easy given the highly political nature of these measures in a city with limited and highly contested urban space. As I will discuss later in this chapter, other cities have achieved success by implementing such measures incrementally over time and building on successful initiatives. But, as Pieterse (2008) and Chatterton (2010) argue, progressive urban futures require continued and organised political pressure by multiple different proponents at multiple different sites of contestation to achieve success. The city's progressive, capable transport commissioner, support from an innovative Mayor, an integrated land-use transport approach and a strong pro-bike lobby are just some of the characteristics of contemporary New York which have allowed innovation to emerge.

3.3 Davis, the United States

"Within the United States, Davis, California is generally recognized as having the most elaborate system of cycling facilities of any American city. It also has, by far, the highest bicycling modal split share (22%), and a very low fatality and accident rate, among the lowest in California".

(Pucher, 2001: 2)

Davis is a small university city in California with a population of 64,000 and a student population of 20, 000 (Pucher *et al*, 1999). It demonstrates that despite a national context of hyperautomobility it is possible to develop local examples of something quite different. It is also a University town/city and therefore particularly relevant as a comparative case for Stellenbosch.

The stand out feature of the city's transport system is the high level of cycling, the highest in the United States. The city has over 80km (50 miles) of bicycle paths and the University campus has an "extensive network" for cyclists including 2.5km of car free streets (Balsas, 2003: 39) It is estimated that there are approximately 15,000 – 18,000 bicycles on the campus everyday (Balsas, 2003: 39). Each day 48% of trips to the University are made either on foot or bicycle, while 38% are made by car. Figure 3.5 shows the University campus and its cycling/pedestrian friendly environment.

Both the city and the University have full time bicycle co-ordinators, secure bicycle storage facilities and each year the city holds a month long "cyclebration". Clearly, the city has a co-ordinated and multifaceted approach to cycling. The city spends significant quantities of money each year to ensure cycling remains an important part of its transport system. Between 1995 and 2005 $14 million was spent on cycling. Balsas (2003) argues that cycling success in a place like Davis is achieved by making every road safe for cycling and developing a comprehensive, user friendly bicycle network that connects important sites both on and off campus (Balsas, 2003). 95% of the cities arterial and collector roads (i.e. roads with high traffic levels) have bicycle paths. As Pucher *et al* (1999: 21) argue:

"Davis campus and the surrounding city prove that a genuine cycling infrastructure can attract and sustain high levels of responsible use even in the car-dependent US".

Figure 3.5 University of California, Davis

Source: UC Davis Magazine.

The city of Davis has had a progressive approach to cycling for a long time. It began incorporating cycling into transport planning in the 1960s. City officials were concerned with "quality of life" issues long before other cities and took steps to prevent car dominance. At the time their actions were considered both "crazy and visionary" (Bike League, 2005). Like Davis in the 1960s, Stellenbosch faces the choice today to support a sustainable future where quality of life is given priority over unlimited provision for the car.

3.4 Copenhagen, Denmark

The city of Copenhagen, with a population of 1.3 million people, is one of the most walking/cycling friendly cities in the world. These achievements did not happen overnight. Indeed, it has been a forty year process involving the incremental expansion of quality public space and cycling infrastructure (Gehl & Gemzøe, 2006: 54).

During the 1960s Copenhagen experienced an economic boom and car use rose dramatically. In 1962 all the "streets and squares" in the central areas were "used intensively" by cars (Gehl & Gemzøe, 2006: 54). In that year the city began a process of pedestrianising Copenhagen's 1.1 km long main street. This measure was far from uniformly supported by the people of Copenhagen with some businessmen arguing that without cars trade would suffer. Despite this opposition, the scheme went ahead and it "proved to be huge success, in both popular and commercial terms" (Gehl & Gemzøe, 2006: 54). Slowly the number of pedestrian streets began to grow until a complete network was in place totally 100, 000 square metres of space "reserved for public life". On street parking spaces were removed (2/3% annually) to provide space for pedestrians and recreational activities, bringing life to the streets of the city (Gehl & Gemzøe, 2006).

In the 1970s and 1980s a combination of the "energy crisis, recession and increased congestion" (City of Copenhagen, 2009: 9) saw a growing consensus develop around the need for alternatives to the car. Massive public demonstrations placed pressure on the Government to improve the conditions for cycling. As a result investment began to flow into expanding cycling infrastructure and forty years later Copenhagen has a very high level of cycling (City of Copenhagen, 2009).

Critical to the process of public space "reconquering" has been the provision of alternative ways of accessing the town centre. Public transport and cycling provide real alternatives to car travel. Driving into the centre of town is inconvenient due to a lack and the expense of parking. Gehl & Gemzøe (2006) argue that, politically, the key to the success of Copenhagen's approach has been the incremental implementation of public space and transport policies over a long period. This has allowed decision makers to move forward based on the success of previous projects and for the public to get used to gradual changes and not be overwhelmed by widespread pedestrianisation or car restrictive measures (Gehl & Gemzøe, 2006).

Today Copenhagen has approximately 350km of dedicated bicycle lanes as well as a wide range of co-ordinated measures to promote, safeguard and prioritise cycling, such as bicycle priority at busy intersections. As a result of these measures an astonishing 37% of commuter's cycle to work and school every day (Figure 3.6) totally 1.2 million km cycled in total each day (City of Copenhagen, 2009). The goal of the Government is to increase the number of people cycling to work to 50% (City of Copenhagen, 2009). A third of journeys to work are taken by bicycle, a third by car and a third by public transport (Gehl & Gemzoe, 2006).

As a result of these measures Copenhagen managed to keep traffic levels virtually constant between 1970 and 1996 despite increasing levels of car ownership (Gehl & Gemzoe, 2006). Today the city centre of Copenhagen has just 3000 parking spaces compared to the 4083 parking spaces provided just on the University of Stellenbosch main campus (Vela VKE, 2011).

It is important to note that Copenhagen is a wealthy, economically prosperous city with a high quality of life and yet for the last forty years it has slowly been restricting the use of the car by providing more space for pedestrians and cyclists. Rather than undermining economic prosperity this has helped the city to flourish and has enhanced its sustainability. This is a further indictment of the belief that the unlimited expansion of motor vehicle traffic is essential for economic growth and prosperity. The dominance of resource/waste intensive private cars is not a given.

Pucher and Buehler (2008) provide an overview of the conditions necessary to make cycling a "safe, convenient and practical way" of getting around (Pucher and Buehler, 2008: 495). By examining urban areas with high levels of cycling, the authors argue that the key to success "appears to be the provision of separate cycling facilities along highly travelled roads and at intersections, combined with traffic calming of most residential neighbourhoods" (Pucher and Buehler, 2008: 495).

Figure 3.6 Cyclists in Copenhagen

Source: Peel, 2009.

In addition, a comprehensive range of supportive policies aid in encouraging widespread bicycle use including the provision of secure bicycle parking, traffic education of motorists and cyclists and promotional events. Complementary transport and land use policies which make driving expensive and inconvenient and keep distances short are an important part of the city's cycling success. Ultimately, the authors argue, success depends on the "coordinated implementation of this multifaceted, mutually reinforcing set of policies" (Pucher and Buehler, 2008: 495). Countries which have taken such an approach (Denmark, Germany and The Netherlands) have succeeded in developing high levels of urban cycling. This is primarily because cycling is much safer in these countries than it is in other countries

such as the United States or even the United Kingdom (Pucher and Buehler, 2008). A comparison between the U.K. and Germany is indicative in this regard. Of the two countries Germany has a significantly higher level of car ownership than the U.K. but the share of trips made by bicycle if "almost ten times higher in Germany than in the U.K." (Pucher and Buehler, 2008: 499).

The case of Copenhagen reinforces the notion that wealth is not always synonymous with urban car dominance. It is possible for a city to achieve high levels of well-being without the car being the primary means of transport. This results in a more socially, economically and ecologically sustainable city.

3.5 Freiburg, Germany

Freiburg is a thriving University city of 220, 000 people in Germany; a country with the highest motorisation rate in Europe. The city is widely recognised as Germany's green capital. The city shifted to a path of sustainability in the 1970s when a strong civil society movement opposed the development of nuclear energy in the region. This coalition was intent on developing a more sustainable approach to energy use in the city, including in its transport sector. In addition, citizen groups lobbied the government to restrict car access to central areas (Buehler & Pucher, 2011).

The development of a more sustainable transport system in Freiburg faced many obstacles. For example, business owners opposed the creation of a pedestrian zone in the 1970s but eventually agreed to the proposal once city authorities agreed to provide parking at the edge of the pedestrian zone (Buehler & Pucher, 2011: 63). Like Copenhagen, Freiburg has often achieved success by experimenting/innovating with relatively small scale projects which, if successful and supported by the public, expanded over time.

The city has a relatively long history of implementing sustainable transport initiatives:

- The city developed its first bicycle network plan in 1970.
- In 1973 the city centre was converted into a pedestrian only zone.
- The city's 1981 land-use plan emphasised the location of new development in close proximity to public transport.
- In 1987 the city council approved traffic calming in all neighbourhoods, reducing speeds to 30km/h.
- Between 1993 and 2006 the public transport orientated, 'car-reduced' Vauban neighbourhood was redeveloped (Figure 3.12).
- By 2007 there were 410km of bicycle lanes.
- By 2008 there were 177 home zones within the city with speed limits of 7km/h.
- The city's most recent land-use and transport plans were developed "simultaneously and are fully integrated" (Buehler & Pucher, 2011: 57).

- The city has banned all “car-dependent big box retailers” (Buehler & Pucher, 2011: 57).

- As of 2009 the city’s light rail system runs entirely on renewable sources of energy.

(Buehler & Pucher, 2011).

Freiburg clearly displays one of the most sustainable transport approaches of any city and has strongly implemented innovative measures that have made it a more liveable place.

Figure 3.7 Vauban’s people friendly streets

Source: City of Freiburg

Prior to the 1970s, the city’s motorisation rate (number of cars per 1, 000 people) was higher than the national rate. However, as I mentioned above, the city’s approach to transport changed during that decade. Alternatives to the car were enthusiastically supported in conjunction with car restrictive measures. The city has developed better public transport (light rail and buses), liveable public spaces and car free/car restricted neighbourhoods. It has numerous walking and cycle lanes which are separate from road networks and therefore encourage NMT use by providing safe and attractive alternatives to the car (Schiller *et al*, 2010). Schiller *et al* (2010: 284) argue that Freiburg has “perhaps one of the most coherent and attractive urban environments in any city, one that is inclusive of all members of the population, regardless of age or ability”.

Consequently, the motorisation rate stabilised at 420 cars per 1,000 people (23% lower than the German average), remaining at that level between 1990 and 2006. At the same time, the share of trips made by bicycle rose from 15% to 27%, public transport use rose from 11% to 18% and 23% of trips are made on foot (Buehler & Pucher, 2011).

The shift in favour of sustainable transport modes saw per capita transport CO_2 emissions decline by 13.4%. In addition, all parts of the town are now easily accessible by public transport, walking or cycling; greatly enhancing social equity. Freiburg is a “‘city of short distances’ with a policy of decentralised but concentrated services and markets, focused on

limiting urban sprawl and encouraging inner-city redevelopment" (Schiller *et al*, 2010: 282). Buehler & Pucher (2011) argue that the combination of improving the alternatives to the car (carrot) and restricting car use (stick) has been vital to the success of Freiburg's transport initiatives:

"…car restrictive measures are not viewed as punitive, since car users are offered safe, convenient, and affordable alternatives".

(Buehler & Pucher, 2011: 51)

The case of Freiburg again shows that the transition to a more sustainable, better quality, and less car dependent city can be achieved in conjunction with high standards of living and a growing economy. This is primarily dependent upon the existence of alternative means of getting around. Quality public transport is required for longer trips and safe walking and cycling environments for short ones. The case of Freiburg illustrates that encouraging walking and cycling necessarily requires restricting car movement through the use of pedestrian zones, traffic calmed neighbourhoods, shorter distances and more space for cyclists and pedestrians. It also shows us how pressure from local groups was important in the development a more sustainable transport system.

3.6 Curitiba, Brazil

Curitiba is a well-known and oft-cited example of sustainable transport innovation. Since the 1970s it has been implementing policies designed to create a balanced and sustainable transport system. This process has been driven by progressive political leadership and the development of strong planning capacity. It provides an example to the rest of the (developing) world of an alternative urban development trajectory, one in which development is centred on the bus, not the car. During this period the city experienced considerable growth (an average of 7% over 30 years) and yet it has done so without becoming car dependent. Real alternatives to the car are widely available in the city. According to ICLEI, a key element of the city's success has been its integrated, people-centred approach to all aspects of city life (ICLEI, 2002).

Curitiba is a city in a developing country with high levels of poverty and limited resources. Despite these limitations, the city of 1.6 million people has managed to develop a highly effective and equitable urban transport system, the centrepiece of which is its rapid bus transit system, used by 2 million passengers per day (ICLEI, 2002).

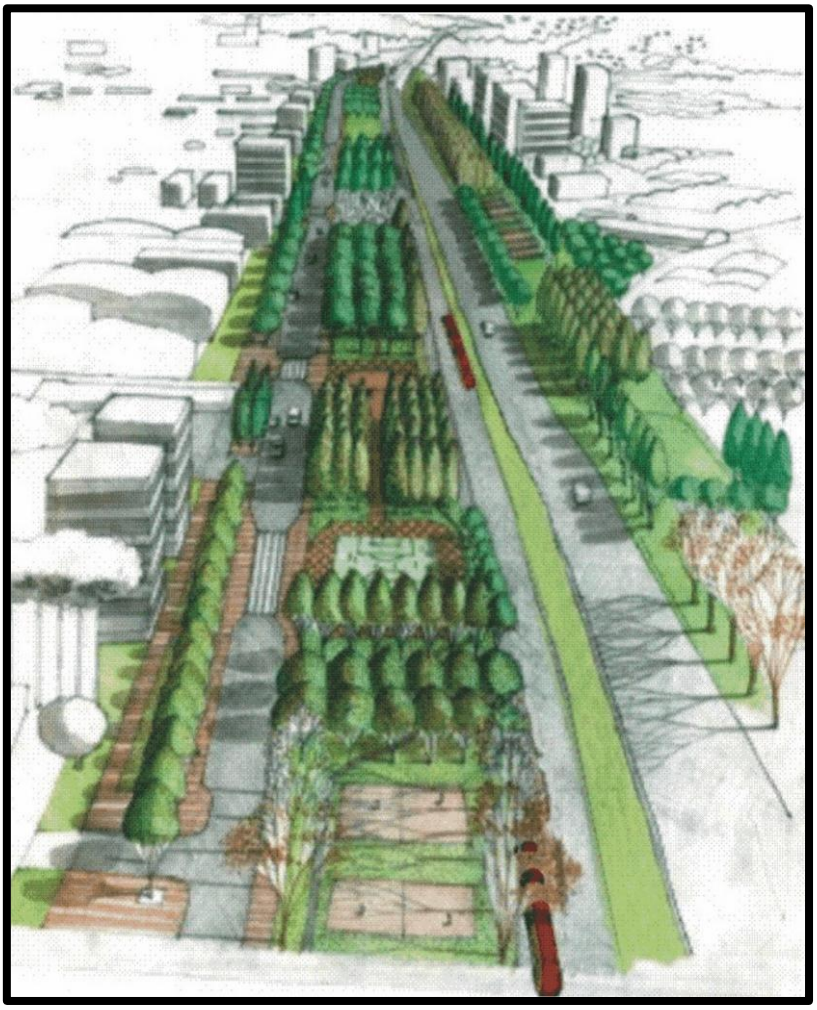
Over the past 30 years, the city channelled development into high density bus corridors. This facilitated convenient accessibility to the rapid transit system. Many of the standard features of contemporary BRT systems were first developed in Curitiba including separated bus lanes, pre-purchase of tickets and level entrances. As the name suggests, this system allowed for rapid movement across the city, as busses moved swiftly along exclusive traffic free lanes. The city has successfully distributed scarce urban space away from the car to modes of transport which support equitable and green development (O'Meara, 1998).

The results of these initiatives are clear with approximately 75% of commuters using the bus to get to work and a 30% reduction in traffic since 1974 despite a doubling in the population over this period (O'Meara, 1998 and ICLEI, 2002). In addition, the city has the lowest levels of atmospheric pollution in Brazil (ICLEI, 2002).

In addition, the city began a process of pedestrianisation in the city centre in 1972, which by 1998 has grown to cover 50 city blocks (O'Meara, 1998). The pedestrianisation of city streets was initially opposed by local businesses but, after the success of the first pedestrian project, businesses began requesting expanded pedestrian precincts. In addition, the city has an extensive system of bicycle lanes (200 km), quality public spaces and parks. The city has also paid particular attention to preserving its historic buildings and, in the process, providing an attractive and walkable city centre (O'Meara, 1998).

Recently, the city has continued to innovate in the area of urban transport through the development of a Green Line (Figure 3.8 below). The Green Line is designed to integrate 23 separate neighbourhoods and uses buses which run on bio-diesel. This project saw the revamp of one of the city's motorways into a new sustainable transport corridor. As a motorway the site was inaccessible and dangerous for pedestrians and was not integrated into the surrounding areas. Now space has been created for bus rapid transit lanes and enhanced bicycle and pedestrian facilities. Particular attention was paid to creating a pleasant NMT experience along the route through landscaping. City officials have treated the Green Line like an urban park, with green spaces between the different lanes (Almeida, 2009).

Figure 3.8 Green Line conceptual drawing



Source: Almeida, 2009

With a development path which departs significantly from car dominance, Curitiba provides one of the most impressive examples of sustainable transport in the developing world and , as a result, is frequently held to be a model of excellence in urban and transport planning (O'Meara, 1998). Not only does the city consume less energy/oil and produce less pollution as a result of these measures, but it also supports a more equitable way of life due to the provision of modes of transport that are accessible to the poor.

3.7 Bogotá, Columbia

Like Curitiba, the city of Bogotá in Columbia is oft cited as an exemplar of sustainable transport policy and practice. Bogotá is a relatively poor city within a developing country without the wealth of cities such as New York or Copenhagen. Despite these limitations it has made dramatic improvements to public space and sustainable modes of transport. This has largely been driven by strong, progressive direction from a "series of political leaders" (Wright & Montezuma, 2004: 1) who recognised the importance of quality transport and public space for urban development and as a result have fought to win back space from the car in this traffic clogged, automobile "invaded city" (Gehl & Gemzøe, 2006).

Bogotá is a "large, densely-populated city with 7 million inhabitants and approximately 230 inhabitants per hectare" (Wright & Montezuma, 2004: 3). Only 15% of the city's population can afford to drive a car (Valderrama and Jørgensen, 2005: 202). High density, mixed used neighbourhoods are commonplace and this has facilitated the roll out of enhanced public transport and NMT infrastructure and services (Cervero *et al*, 2009). Bogotá has adopted a comprehensive approach to changing the transport system and the quality of the public realm by implementing the following complementary measures:

- *"Reclamation of public space"*
- *"Improvement of public transport"*
- *"Promotion of non-motorised transport"*
- *"Implementation of auto restriction measures"*

(Wright & Montezuma, 2004: 3/4)

Specific initiative include:

- The swift (over 3 years) roll-out of a bus rapid transit (BRT) system (figure 3.8) which uses 58 km of dedicated bus lanes and accounts for 900, 000 trips daily (Peñalosa, 2006; Wright & Montezuma, 2004).
- The construction of 300km of protected bicycle lanes which has seen cycling rise from 0.4% of all trips to 4% of trips (Peñalosa, 2006; Wright & Montezuma, 2004). The former mayor of the city Enrique Peñalosa believes that "bicycle paths are a symbol of respect for human dignity and of a more egalitarian city, as are high quality walkways. Both show that a city is for its people, and not for the motor vehicles of its upper classes as is so often the case" (Peñalosa, 2006: 10).
- The expansion of the Ciclovіá network: Ciclovіá are roads which are closed on Sundays, public holidays and special occasions so that they can be used by

pedestrians, street traders and cyclists (see figure 3.9 below). This process began in 1982 and has been expanded to over 120 km of the city's main roads (Wright & Montezuma, 2004: 6). The Ciclovià are used by 1.5 million people every weekend creating a vital space for social interaction in a city beset with crime and inequality. In addition, the city celebrates an annual car free day in which no cars are permitted on the city's roads allowing residents to explore public and non-motorised transport options, if they have not already, and publicly reaffirming the city's commitment to sustainable modes of transport. According to Peñalosa (2006), it also provides a rare opportunity for social integration as all members of society, rich and poor, are required to use public and non-motorised transport.

Figure 3.9 BRT in Bogotá

Source: ITDP

In addition, the city also developed a 17 km long pedestrian/cycling path that connects "several low-income communities to shops, employment, and public services" (Wright & Montezuma, 2004: 6).

The city has imposed several radical measures to restrict car use. 40% of the city's cars are banned from the roads during peak hours every day. Each car faces this restriction twice a week. As a result of this measure traffic is reduced, pollution and fuel consumption have declined and the speed of public transport has increased (Peñalosa, 2006). This, of course, is only possible due to the existence of an alternative to car use, notably the bus rapid transit system. In addition, on street parking has, virtually, been eliminated within the city, in many cases being replaced with pedestrian/cycling facilities or public space (Wright & Montezuma, 2004).

Other cities around the world (such as New York City) have learnt from the experience of Bogotá and have begun to realise that roads/streets can be used for purposes other than car mobility, such as exercise, recreation and social interaction, especially in the evenings, during holidays and on weekends (Peñalosa, 2006). In addition, there are a large number of cities, around the world, which have begun to adopt BRT systems based on the success of the system in Bogotá, including Johannesburg and Cape Town.

Figure 3.10 Cicloviá

Source: Project for Public Space

The success of the initiatives in Bogotá have been attributed to a series of political administrations which were both keenly aware of transport issues and had a progressive approach to transport and its role in the process of urban development. As Wright & Montezuma (2004: 1) argue: "The replicability of Bogotá's successes will depend upon local circumstances and especially upon levels of local political will". In addition, success in Bogotá has been attributed to the implementation of a range of comprehensive, mutually reinforcing measures. However, the rapid improvements that occurred in Bogotá have come under pressure. The number of cars in the city continues to grow rapidly, the mayor who implemented many of the innovative changes lost a re-election bid and recent political administrations have delayed the expansion of the BRT system. This emphasises the important role played by the political will of the powerful and the need for organised pressure from citizens to ensure progressive change continues (Pieterse, 2008). In fact, numerous civil society groups have emerged in Bogotá orientated towards protecting and expanding the transport improvements in the city (ITDP, 2008).

What Bogotá has shown is that it is possible for a city in a developing country context to implement innovative approaches to urban transport problems and to give priority to the mobility of the poor majority rather than the rich minority. This allows for a more egalitarian city to emerge; one in which resource/waste intense car ownership is not necessary for effective participation in city life.

3.8 Guangzhou, China

Guangzhou is a city of approximately 12 million people in Southern China. Recently the city implemented a number of transport projects designed to enhance the sustainability of its transport network. The city is experiencing rapid economic expansion and increasing car use (Zacharias, 2012). Between 2001 and 2007 the private vehicle fleet in the city increased from 150, 197 to 664, 083, representing an increase of 442% (Cao et al, 2009).

In response, the city has implemented a number of transport projects designed to correct this growing imbalance. The core element of this initiative is the recently developed 27km

BRT corridor (see Figure 3.11 below). Opened at the beginning of 2010, it already carries approximately 800, 000 passengers daily, second only to the Transmilenio of Bogota (see page 53). It has also proved able to compete with underground metro systems, with only Beijing's metro lines carrying a higher number of hourly passengers in China (ITDP, 2011).

Figure 3.11 The newly introduced BRT corridor

Source: itdp-china.org

The system is fully integrated with the existing metro lines of Guangzhou. Integrated bicycle lanes, bicycle parking, greenways (figure 3.12 below) and a bicycle sharing scheme were simultaneously introduced. As a result, passengers can seamlessly move from a rapid bus service to either a rented or private bicycle at any of the bus stations. The bicycle sharing scheme provides 5, 000 bicycles for rent. The separated bus lanes are matched by separated bicycle lanes along the entire route, as well as improved pedestrian areas and public spaces along the route. According to a report by the Institute for Transport and Development Policy the BRT system has reduced CO_2 emissions by 86, 000 tons per annum (ITDP, 2011).

Despite these measures politicians, both in the city and in higher levels of government, continue to push for a growth in car acquisition and use in the city principally to support economic development (Zacharias, 2012). This includes plans for the removal of 138 NMT-orientated urban villages to make way for car-orientated infrastructure. However, this is being resisted by local residents who live an entirely non-motorised lifestyle (Zacharias, 2012). According to Zacharias (2012) the continued existence and resistance of these urban villages is an important obstacle to the full scale motorization of Guangzhou.

Figure 3.12 Donghaochong greenway

Source: itdp-china.org

Guangzhou provides an example of a developing world city experiencing rapid change. Like many other developing cities it faces an important choice between an urban way of life centred on the car or enhancing and retaining the high level of NMT use in some neighbourhoods and building on the initial success of its BRT system. While these innovative projects display a commitment on the part of city authorities to a more balanced future, the continued pursuit of enhanced car infrastructure indicates that the future transport trajectory of this developing city is far from certain. However, Guangzhou, like Curitiba and Bogota, does illustrate the potential for cities in the developing world to implement sustainable transport projects which redistribute scarce urban space towards green modes, boost social equity and reduce the environmental impact of development.

3.9 Conclusion

The transport innovations in Freiburg, Bogotá, Curitiba, New York and elsewhere serve as a model to developing countries. These cities have shown what is possible and are exemplars of an alternative approach to transport in which development and growth is increasingly based of resource-light public and non-motorised transport.

The urgent need for a reduction in global resource consumption and waste production demands a move towards transport systems which facilitate sustainable development, i.e. increasing well-being within ecological limits (Gallopin, 2003). If cities in developing countries continue to model themselves on the car-orientated cities of the industrialised world, they face a future of increasing urban vulnerability, growing inequality, environmental degradation, poor public health and high overall transport costs. The supply of oil in the future is, at best, uncertain and, therefore, any urban economy which is overly dependent on the car is likely to experience significant disruption. Many of the cities described in this chapter display an enhanced capacity to deal with these challenges and adapt to changing global realities, i.e. resilience. They have achieved this status as a result of specific circumstances which have enabled innovative urban transport approaches to

emerge, including progressive political leadership, an active citizenry and high levels of capacity.

The high levels of public and non-motorised transport use in developing countries is an advantage that should be capitalised on by dramatically enhancing the quality of these alternatives, restricting car use and encouraging urban forms which support more sustainable modes of transport.

Of course, all the case studies explored above are very different places to that of Stellenbosch. They display different contexts, different levels of capacity, different political dynamics, different cultures and differing historic transport infrastructures. Despite this they show what is possible in world so overwhelmingly dominated by the car and its negative effects on the socio-ecological system. Specifically, the cases from the developed world illustrate that economic prosperity does not have be accompanied by excessive car use. In fact, strong restriction on car use and a parallel support of alternatives can enhance economic prospects and urban sustainability more broadly. While the cases from the developing world show how, even under difficult circumstances, it is possible to implement projects and policies which support a sustainable transport future, one which is socially equitable and ecologically balanced. As such, towns and cities which are still developing, such as Stellenbosch, should learn from the examples in this chapter and chart a course which transcends car dominance.

4. Case study: Stellenbosch

4.1 Introduction

Chapter 2 provided an overview of the problems with and solutions to the dominant urban transport paradigm, as well as the barriers to sustainable transport transition. I argued that the dominant paradigm is deeply problematic due to the multiple ill-effects it has on the socio-ecological system. In Chapter 3, I provided examples of cities and towns which have implemented innovative transport initiatives, despite the powerful barriers to change described in Chapter 2.

This chapter provides an overview of transport in Stellenbosch. It will explore the trends, dynamics and pressures surrounding the town's transport system. It has been constructed by integrating data gathered during the research process including field interviews and documents. From this data it became clear that Stellenbosch faces a number of transport problems and trends which are not consistent with the development of a socially equitable and ecologically supportive transport system.

I begin this chapter with a brief overview of the national context. I then move on to detail the situation in Stellenbosch.

4.1 The national context

Despite almost 15 years of national policy priority to public and non-motorised transport, the South African urban transport system retains a dual structure which is largely a legacy of the apartheid era. On the one hand, there exists a poor quality public transport system primarily servicing low income, captive users who are often forced to spend a significant portion of their income and time on transport, due to the peripheral location of their homes and the sprawling character of South African cities. The urban public transport system includes a passenger rail service, subsidised bus services and the private, largely unregulated minibus taxi industry, which has grown to be the most widely used form of urban transport in many areas of South Africa (Wilkinson, 2008; Wilkinson, 2010). In addition, walking is a highly significant mode of transport for poor South Africans (Wilkinson, 2008). Yet, it is a dangerous and ill-catered for activity:

"A simple matter of crossing the street is therefore the single most important factor causing road crash fatalities in South Africa".

(Behrens, 2005: 175).

On the other hand, the wealthier segments of society rely almost entirely on private cars for transport purposes and often reside in relatively well located suburbs. South African cities are characterised by urban sprawl, car dominated urban environments and poor quality public transport which makes car use a virtual necessity provided you can afford it (Czeglédy, 2004; Wilkinson, 2008; Wilkinson, 2010). As a result, those unable to afford a car are at a distinct disadvantage (Donaldson, 2004; Czeglédy, 2004). Czeglédy (2004) argues that the South African middle classes have a negative perception of public transport, believing it to be both of poor quality and unsafe. He goes on to suggest that this reflects a broader disengagement by this class from public life and a loss of confidence in the ability of the state to provide quality services. Cities designed for the car support this disengagement (Henderson, 2006).

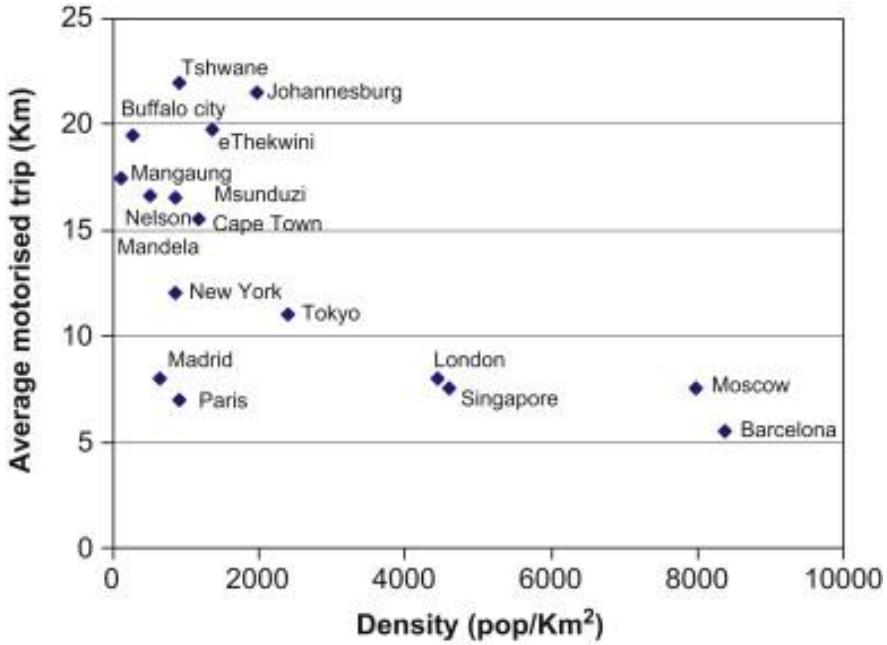
In addition, car culture is deeply ingrained amongst the upwardly mobile South African middle classes, even when compared to the United States, as Van der Westhuizen (2007: 336) argues:

"…in South Africa, access to and ownership of a motor vehicle implies not only greater convenience but confers status and an identity of unrivalled upward mobility. Motor vehicle ownership is a culturally deeply ingrained aspect of South African life: well over R200 billion is spent on personal transport, approximately 15 per cent of gross domestic product (GDP). In contrast, the United States of America, one of the world's most motorised countries spends about 13 per cent of GDP on cars".

Cape Town has approximately 190 cars per 1000 people which is relatively low when compared to Europe and North America (see Chapter 2 and 3). However, the number of cars being sold in South Africa exploded during the years of strong economic growth (2003 - 2006) prior to the recent recession. In addition, Wilkinson (2008) asserts that the "number of households with access to a car increased by 808, 000 or 33% between 1995 and 2003 (DoT, 2006 in Wilkinson, 2008: 208). While, the percentage of people using cars grew from 30% to 45% between 1997 and 2004. Traffic growth in South Africa is between 5% and 6% annually (Vanderschuren et al, 2010a). In addition, due to the sprawling, low density character of South African cities the average length of trips is high when compared to other cities around the world (see Figure 4.1 below).

In 2011, the domestic new vehicle sales market experienced strong growth. New vehicle sales in 2011 were expected to reach an estimated 570, 000 units, 15% higher than in 2010 (Venter, 2012). However, this is still below the pre-recession peak of 714, 000 units (Venter, 2012). The automotive industry is highly significant for the national economy, generating 7% of GDP and providing 120, 000 jobs. The export of vehicles has increased substantially from 15, 764 units in 1995 to 139, 936 units in 2005 (Barnes & Morris, 2008).

Figure 4.1 Average motorised trip length versus city densities



Source: Vanderschuren, 2006 in Vanderschuren et al, 2010a

The growth in car use is placing significant pressure of urban road networks resulting in "increases in average travel times, fuel consumption and exhaust emissions" (Wilkinson, 2008: 208). As will be discussed later, the town of Stellenbosch is currently experiencing similar trends and it struggling to deal with rising levels of car traffic. However, the dynamics of Stellenbosch differ in important ways from the larger Metropolitan areas of Cape Town, Durban and Johannesburg. This will be addressed in greater detail later in this chapter.

The pressure to maintain adequate car mobility continues to result in significant investment in urban road infrastructure. The South African Chamber of Commerce and Industry claimed that congestion in Gauteng cost local businesses up to R15 million per hour (Van Niekerk, 2011). While the Gauteng Provincial Government estimated that congestion could cost the regional economy R155 Billion between 2004 and 2025 (Van Niekerk, 2011). The response included Phase 1 of the Gauteng Freeway Improvement project, projected to cost R21 Billion (Molekoa, 2011). Rather than devoting resources primarily to improving alternatives to the car, decision makers have devoted billions to major road capacity improvements despite the fact that it is now widely accepted that congestion cannot be resolved satisfactorily through increased capacity and that a certain level of congestion is important for making other modes, such as the Gautrain, more attractive (Kenworthy, 2007).

Historically the needs of public transport users, pedestrians and cyclists have largely been ignored by transport professionals in South Africa, with the result that our towns and cities are car dominated, sprawling places with poor quality public transport and dangerous walking and cycling environments (Behrens, 2005). This is slowly changing, not least because of the focus placed by national policy on improving public and non-motorised transport. Wilkinson (2008) argues that it is crucially important to enhance the viability of alternatives to the car. At present the urban modal split for work trips in South Africa is in favour of public transport (56:44) and it is vital that this is defended and improved upon as the basis for a sustainable transport future. This will require reversing the decline of South African urban public transport and enhancing the quality of walking and cycling environments (Wilkinson, 2008: 216). Crucially, Wilkinson argues that a new approach to transport will require a move away from the "business as usual mentality" (Wilkinson, 2002: 8). This includes the "long standing investment of possibly the majority of established transport planners and engineers in "predict and provide" rationality and practices" (Wilkinson, 2008: 217).

In addition, the South African transport sector is heavily dependent on oil. In 2006 the transport sector consumed 26.8 % of final energy (DOE, 2009). In the transport sector 97% of energy requirements are fulfilled by petroleum products, while electricity supplies 3% of energy to this sector (Haw & Hughes, 2007). Meanwhile, road transport consumes 84% of energy in the transport sector and 80% of petroleum products are imported (DME, 2004). Crude oil "represents the single largest item on South Africa's import account" (DME, 2004: 33). South African crude oil imports have grown from approximately 8 million tons in 1994 to approximately 16 million tons in 2007 (Wabiri and Amusa, 2010). Vanderschuren *et al* (2010b: 6092) suggest that this indicates a significant exposure to external oil supply risks for the South African economy:

"The South African transport system is highly exposed to the risks associated with peak oil and fuel price spikes, given the extent to which petrol-driven private cars, mini-bus taxis (MBTs), and diesel-powered trucks provide transportation for the vast majority of commuters and businesses".

In the city of Cape Town, the transport sector is responsible for 50% of final energy consumption. Fossil fuels (petrol and diesel) supply 98% of the energy to the city's transport sector and it generates 29% of the cities CO_2 emissions (Ward & Walsh, 2010).

From the data presented above, it is clear that the South African transport sector is heavily dependent on oil. Not only does this expose the country's economy to serious risk (see the discussion on peak oil in Chapter 2), it also suggests that the transport sector makes a significant contribution to local and global ecological destruction. The development of sustainable urban transport systems, which are significantly less reliant on fossil-fuels, would help to rectify this situation. Necessarily, this includes the town of Stellenbosch. Reforming the transport system there is part of a broader process of enhancing the resilience and sustainability of the South African socio-ecological system as a whole.

In the next section, I will briefly review South African national transport policy.

4.1.1 National policy response

Soon after the advent of democracy in 1994, the focus of South African national urban transport policy shifted to:

- Public transport (PT),
- Non-motorised transport (NMT)
- Integrated transport and land-use planning and
- Travel demand management.

(Wilkinson, 2008).

This step change in transport policy was in response to the severely inequitable state of the urban transport system, as described above. The publication of the White Paper on National Transport Policy (1996) was the first step in this process. It laid out the normative vision for transport in South Africa which is reproduced below:

"…provide safe, reliable, effective, efficient, and fully integrated transport operations and infrastructure which will best meet the needs of freight and passenger customers at improving levels of service and cost in a fashion which supports government strategies for economic and social development whilst being environmentally and economically sustainable."

(DoT, 1996:3 in Wilkinson, 2008: 209).

In 2009 the latest embodiment of National Government's approach to transport was produced in the form of the National Land Transport Act (No. 5 of 2009) which reiterated the Government's commitment to reshape urban transport systems by giving priority to more sustainable modes of transport, i.e. PT and NMT. In addition, the Act emphasised the central role of local government in realising this vision through the production and implementation of Integrated Transport Plans (Wilkinson, 2010).

The awarding of the 2010 Fifa World Cup to South Africa resulted in a significant increase in investment in urban passenger transport systems from 2006 onwards with the emphasis on "integrated mass rapid transport networks" (Wilkinson, 2010: 393) in the large metropolitan

areas. Controversially, this included a R26 Billion investment in the Gautrain Rapid Rail Project which was primarily designed to attract (middle/high income) car users (Donaldson, 2006). The system links higher income areas of the Gauteng conurbation with a brand new high speed rail service, while the Metrorail commuter service in the Province continues to suffer from a lack of investment and a generally poor quality service (Donaldson, 2006; Mahlong, 2010). Recently, National Government has stepped up efforts to revive the urban rail system. This includes a planned R125.3 Billion investment between 2015 and 2025 to purchase 7, 200 new rail carriages, to replace the current rapidly aging fleet (Esterhuizen, 2011).

Although selected improvements are being made as a result of this investment, the dual nature of our urban transport system remains intact and "at present, none of the major public transport modes can be deemed to offer adequate or acceptable levels of service to their essentially captive markets, or to provide any real incentive for car users to switch modes" (Wilkinson, 2010: 393). Writing in 2008, Wilkinson argues that there has been a "demonstrable lack of progress" (210) towards achieving the goals laid out in national transport policy.

There remain significant challenges for the restructuring of South Africa's urban transport system which will be discussed briefly below.

4.1.2 Barriers to transport system change

Firstly, the various role players within the transport sector lack the capacity to adequately address the complex and challenging issues at hand (Wilkinson, 2008). This is particularly acute at the local government level where the capacity to implement integrated transport plans (ITPs) is often lacking (Wilkinson, 2008). In addition, a dramatic improvement in urban transport systems requires significant financial investment and there is uncertainty at the local level about how to fund upgraded transport systems in the long term (Wilkinson 2008; Wilkinson, 2010).

Secondly, there exists a high level of fragmentation within the South Africa transport system. As a result co-ordinating the various elements of the urban commuter transport system is problematic:

"In general, despite broad recognition that it requires major reform, the institutional framework for public transport provision in the metropolitan cities remains highly fragmented and incoherently configured. Agencies of all three spheres of government, parastatal or state-owned enterprises, formal private sector operators, and paratransit operators interact in complicated and sometimes not very formally institutionalised ways to carry out the planning, regulatory, operational management and funding functions associated with the provision of infrastructure and the delivery of public transport services. In important respects, this institutional framework has become patently ineffective and is now widely regarded as unsustainable".

(Wilkinson, 2008: 207).

In addition, the historically fragmented interaction between land-use and transport planning agencies/departments is problematic given the centrality of integrated transport and land-use planning to sustainable transport system transition. Land use planners are often primarily concerned with "improved accessibility for pedestrians and public transport users" while transport planners and engineers are chiefly concerned with "increased mobility for

private transport users" (Wilkinson, 2002:8). This is reflected in the "different values, performance criteria and approaches to 'problem framing' [which] continue to divide professionals working in the two fields, despite the adoption of a common rhetoric of 'integrated cross-sectoral planning'" (Watson 2001 in Wilkinson, 2002: 7). Furthermore, the concerns of transport planners and engineers are often given priority over those of land use planners "on the grounds of ostensibly 'technical' considerations related to the application of standardised traffic engineering norms and codes of practice" (Wilkinson, 2002: 8).

4.1.4 Distorted priorities

From the above arguments, it is clear that the South African transport system is both highly inequitable and faces a series of obstacles to any kind of effective transition. Drawing on the work on Vasconcellos (2001) and Beaton (2000) is can be argued that there are a number of problems facing transport decision makers in South Africa. Firstly, the traffic jams of the car-driving elite generate pressure for this congestion to be satisfactorily resolved so as to ensure the reproduction of the middle class (Beaten, 2000; Vasconcellos, 2001). At the same time, the poor majority struggle to participate effectively in urban life due to their dependence on poorly catered for transport modes.

As we saw in Chapter 2, the sustainable approach to resolving congestion is to improve green modes and to make private car use increasingly inconvenient. However, in a developing country the principle area of concern should not be resolving the traffic jams of the rich but on improving the mobility and access of the poor. Fortunately, the solutions to these two problems can be quite similar. It is, however, important to remain explicit about what each project or intervention is designed to do (Vasconcellos, 2001). From this perspective large scale investment in freeway expansion or the construction of high speed rail services aimed primarily at the middle class cannot be viewed as contributing effectively to the central issues of equity or sustainability.

While it is important to ensure that the middle class is able to effectively move around the city this should not detract from the radical need to reconfigure the South African urban transport system so the role played by green modes of transport is reinforced and expanded. Currently South African's abandon public transport as soon as they are able to do so (Wilkinson, 2008). It is absolutely essential that this ceases to be the case. Improving the transport experience of the poor majority should be the primary focus of transport decision making. A beneficial side effect of this should be the overall improvement in green modes which provide car drivers with a resource-light alternative and facilitates the implementation of policies which make driving less attractive.

The global "system of automobility" (Urry, 2004) is very much a reality in South African cities; with their car-oriented design, sprawling low density urban sprawl, poor quality alternatives as well as the institutions, funding streams and ways of life which collectively combine to perpetuate car dominance. All contribute to a situation in which car ownership is necessary for a decent quality of life leaving those without access to a car at a significant disadvantage. In Chapter 3, I explored cities and towns in which real alternatives to the car do exist and in which the middle class does not depend, so completely, on the car. A more sustainable approach to transport is clearly possible. The cases drawn from the developing world clearly illustrate that this is possible even in a context of limited resources and capacity.

Despite the strength of this regime, there are innovations occurring within the South African urban transport system which depart from the paradigm of car dominance, such as the bus rapid transport systems in Johannesburg and Cape Town, the new cycle lanes and public spaces of Cape Town and the Gautrain, although as mentioned earlier the latter project is particularly problematic from an equity perspective.

It is in this context that the Stellenbosch transport system exists. Like Cape Town, Durban, Johannesburg and other South African cities it faces many of the issues, challenges and barriers described above including limited resources and capacity, institutional fragmentation and constraints, a lack of quality alternatives to the car, sprawling urban development, a deeply inequitable transport status quo and expanding congestion problems.

4.2 The case of Stellenbosch

4.2.1 Introduction

Stellenbosch is a rapidly growing town, 50km from the city of Cape Town, in the Western Cape Province of South Africa. The Stellenbosch Municipal area includes the towns of Franschhoek, Pniel and Klamputs, amongst others, but this research project has solely examined the town of Stellenbosch itself. The Stellenbosch municipal area had a population of approximately 147, 000 people in 2010, with about half (73, 774) residing in Stellenbosch town itself. The population growth rate is estimated to be in the region of 2% annually (CNdV Africa, 2010a). It is estimated that 17.1 % of the population is unemployed and Stellenbosch has a "relatively poor population with the majority of households earning less than R3500 per month" (CNdV Africa, 2010a: 154). The economic growth rate for the Municipality was 4.41% between 2000 and 2004. The town has experienced and continues to experience high levels of growth driven by its status as a national and international tourist destination, a highly desirable upmarket residential and retirement location, the primary centre of South African wine making, a popular location for business headquarters and the presence of a rapidly growing University (Van der Merwe, 2004). This consistent growth has had implications for traffic levels in the town and has forced decision makers to address the consequences of growth which, in the case of Stellenbosch, is heavily dependent on the private car, as I will make clear below.

The University plays an important role in the town. In 2001, the total student population was 18, 731. In 2010 the total student population on all the University's campuses has grown to 27, 634, a 48% increase between 2001 and 2010. Between 2009 and 2010 alone student numbers increased by 5.5% (Stellenbosch University, 2011). Approximately 21 000 students attend class on the Stellenbosch campus itself (Vela VKE, 2011). As a result of the high number of students residing in Stellenbosch the town experiences significant shifts in population, traffic, accident rates and retail turnover depending on the movement of students in and out of town (Bester *et al*, 2011; Vela VKE, 2011).

In the last five years the Stellenbosch Municipality has experienced a high level of political instability with control passing between the Democratic Alliance and the African National Congress twice since 2006 (Botha, 2011). Recently the Democratic Alliance won a decisive victory in the local government elections, giving the party control of the Municipality. There have also been allegations of tender irregularity and corruption within the Municipality specifically with regard to the development of World Cup viewing stadia and the tender process for the development of strategic land owned by the Municipality, Tender 34. As a

result the Special Investigation Unit (SIU) launched an investigation into "alleged fraud and corruption" in Stellenbosch (Ndenza, 2010). In 2010 the town's former mayor was arrested on charges of tender fraud and corruption (Property 24, 2011).

Officials in the Municipality suggested that the frequent political upheaval in recent times has made their work very difficult. According to one official it was a "terrible time", proving to be the "single biggest reason" for a failure to implement projects (De le bat, 2011c). According to one senior Municipal official:

"We work under a lot of pressure in this town…so we are under a lot of pressure and so you can accept that sometimes the work is not being done 100% right. I've lost very good people, we had three very, very good people and they were very loyal as well. There are different reasons. Money is one of them, but not the only reason why they leave. Other internal issues and consistency and stuff which also eventually has a problem [sic]".

(Van der Merwe, 2011a).

It was also suggested that the Municipality has difficulty retaining or finding highly skilled/experienced professionals (Van der Merwe, 2011a). Staff shortages limit the ability of officials to focus on anything but the most pressing matters (Van der Merwe, 2011a). Several of those interviewed argued that the Municipality is very good at hiring consultants and producing reports/plans but where the Municipality fails is in implementation due to a lack of capacity, political will and competing priorities (De le Bat, 2011a; Groenewald, 2011; Opperman, 2011; Van der Merwe, 2011a). The following statement from the Municipality's Transport Manager is indicative in this regard:

"We plan and it becomes documents that go into the shelf and it never gets implemented or it never gets to a stage where council approves it or accepts it which makes it difficult to have a strategy that can be implemented [sic]".

(Van der Merwe, 2011a).

The Director of Planning and Development in the University's Facilities Management department makes a similar point:

"The biggest problem is I've been in Stellenbosch for many years now first as a student, then working – over all those years the Municipality has been planning for alleviating the transport problems, and there were various plans on the table, of which virtually none were ever operationalized…If you look at the traffic situation in town, from a traffic engineering perspective, we've reached gridlock. You cannot sometimes get out of town. The traffic just comes to a standstill. That means we now have a problem [sic]".

(Opperman, 2011).

Additionally, the Municipality's newly appointed Director of Engineering Services suggests that years of political upheaval in the town made service delivery difficult. As a result, infrastructure was not correctly maintained and the focus, now, is on bringing infrastructure up to standard, especially the waste water treatment facilities. According to the Director, the maintenance/infrastructure backlog for the Municipality stands at approximately R1 Billion. As a result Stellenbosch is said to be experiencing a "services crisis" because existing infrastructure has reached or is fast approaching its capacity, specifically waste water, potable water, landfill, electricity and, indeed, transport infrastructure (De le Bat, 2011b). As one local councillor argued:

"Now, our water is scarce, our rubbish tip is way over capacity, our sewerage farm is way over capacity and our roads are clogged and our parking is finished. So we cannot take much more growth" [sic].

(Botha, 2011).

Moreover, the town of Stellenbosch and the Municipality as a whole does not have an approved spatial development framework (SDF), a document intended to guide development. The town's *draft* SDF emphasises the following:

- Contain development within an urban edge
- Densification to create the conditions necessary for public transport
- Development based on walking distance rather than convenient car access
- Socially integrated development

(CNdV Africa, 2010).

The document places significant emphasis on supporting public and non-motorised transport as the following extracts illustrate:

"Within urban settlements pedestrian movement should be prioritised in the circulation pattern of the streets and the design of street cross-sections".

(CNdV Africa, 2010: 48).

"…high quality main street environment with equal emphasis on pedestrians, cycles and motor vehicles, rather than prioritising motor vehicles".

(CNdV Africa, 2010: 72).

However, as mentioned above, the draft SDF of 2010 has not been approved by the Municipal Council. As a result, the town lacks strong spatial guidelines and ad-hoc development is often given approval even though it is outside the proposed urban edge or not in keeping with the vision and principles of the draft SDF. Officials in the Municipality suggested this occurred for political reasons and in some cases Municipal decisions were overturned at a provincial level (De le Bat, 2011a and Van der Merwe, 2011). Two senior Municipal officials made the following statements in this regard:

"If someone wants to develop outside of that area [the urban edge], it's going to be a political decision eventually, because it brings economics to the town and it eventually will still happen. The chance is it will happen. And we've shown in the past that it does happen [sic]".

(Van der Merwe, 2011a).

"What we do now is that we get applications for 4/5/6 story buildings and we just say that's job creation so it gets approval. We don't measure the impact of that development in terms of its impact on the town [sic]".

(De le Bat, 2011a).

According to Municipal officials, this is indicative of a broader trend within the Municipality of reactive, "short term" responses to problems as opposed to a longer term, strategic approach (De le Bat, 2011a, 2011c and Van der Merwe, 2011):

"normally we just have enough money to do the necessities. Grand planning like new urbanism or pedestrianisation, that will take some really hard work [sic]".

(Botha, 2011).

So, clearly, the capacity of the Municipality to address issues of sustainable transport is limited given the institutional, capacity and political problems it faces. I will now provide a short overview of the Stellenbosch transport system and the dynamics thereof. Please refer to the maps provided in the appendices if required.

4.2.2 The Stellenbosch transport system

"The increasing activity in the town, the consumption of land or urban sprawl and growth in private commuter trips into Stellenbosch combine to put an increasing burden on the local environment and the road system. The environment and historical core of the town is being severely affected mainly by the high number of private vehicle trips".

(ARUP, 2007: 3).

As the above quote indicated, Stellenbosch faces a number of serious transport challenges. The town of Stellenbosch displays many of the hallmarks of an urban area dominated by the car. As I will make clear below, the Stellenbosch transport system is characterised by:

- high and growing levels of vehicular traffic
- car-orientated street design (Figure 4.2 depicts a street in a Stellenbosch suburb. No provision is made for walkers or cyclists, suggesting a design ethos based on the idea of universal car ownership and car dependence)
- a car invaded (Gehl & Gemzøe, 2006) urban environment, with scarce urban public space being occupied by cars
- generally poor provision for walkers and, in particular, cyclists
- a complete lack of quality public transport services and
- an ever expanding urban form.

The Stellenbosch transport system has a number of component parts. Central Stellenbosch is flat, relatively compact and has a mix of uses, providing a strong foundation for non-motorised transport. In addition, the town displays a high level of walking activity, while cycling plays a minor role, being utilised primarily by students and low income individuals. According to the town's interim transport plan:

"Walking is the most commonly used mode of transport in Stellenbosch. Bicycles are a simple yet effective means of transporting both people and light freight, however they are totally under-utilised".

(ARUP, 2007: vi).

However, various factors have and continue to undermine the role of NMT in the town. An issue I will return to below.

Figure 4.2 Car-orientated street design in Stellenbosch

Source: Google

The only road based 'public' transport system that exists in Stellenbosch is provided by the private minibus taxi industry, whose services are used almost entirely by lower income groups. According to Vela VKE (2011), 78% of motorised trips made by low income residents are by public transport, primarily minibus taxis. Kayamandi, Idas Valley and Cloetesville are low income neighbourhoods on the northern edge of Stellenbosch. Residents of these neighbourhoods make extensive use of public and non-motorised transport, as the following quote makes clear:

"There are significant commuter pedestrian flows between the suburbs of Kayamandi, Cloetesville and Idas Valley and Stellenbosch Town".

(Vela VKE, 2011).

Stellenbosch is connected to the broader region, including the city of Cape Town, via a poor quality rail service but, again, this is principally used by lower income residents.

Concurrently, middle and upper income residents of Stellenbosch make extensive use of the car (ARUP, 2007; Vela VKE, 2011). According to the town's Comprehensive Integrated Transport Plan (CITP): "The higher and middle income residents make almost exclusive use of the private car as mode for commuter transport" (Vela VKE, 2011).

It is clear that the transport situation in Stellenbosch is comparable to that of other South African urban areas. The middle and upper classes are largely car dependent while the poor have to endure a poor quality, unsafe transport experience in an urban environment designed principally for car mobility.

However, Stellenbosch differs in a number of important ways from the sprawling Metropolises of Cape Town, Durban and Johannesburg. Firstly the core of the town remains relatively compact with a mix of uses including residential, retail, education, leisure and commercial activities (see Figure 4.3 below)(CNdV Africa, 2010). As a result movement by non-motorised means remains viable in some cases.

Figure 4.3 The compact, mixed use historic core and University campus of Stellenbosch

Source: CISabroad

In addition, there have been several attempts to enhance pedestrian infrastructure in the historical core and around the University campus (see Figure 4.4 and 4.5 below). Furthermore, the relatively close proximity of low income neighbourhoods, such as Kayamandi, means that walking to town for work, for example, remains a viable alternative for many low income residents.

Problematically, Stellenbosch has increasingly begun to suffer from congestion and parking problems. The town and the University continue to grow and traffic has increased as a result, as the following quote indicates:

"In the recent past the university and the town have been subjected to explosions in terms of student numbers and developments, which have resulted in the surfacing of structural deficiencies in the capacities of the road and transport networks".

(Vela VKE, 2011).

As an historic town with relatively narrow streets and a multitude of historic buildings, features and trees, road capacity expansion (widening) is often not possible within the central areas (Van der Merwe, 2011a; Winter & Groeneweld, 2011). Limited resources have also hindered capacity expansion projects (Winter & Groeneweld, 2011). Similarly, the transport consultants who drafted the CITP assert:

"There is hardly any relatively cheap land available in Stellenbosch and its environs for either open parking lots or elaborate new road schemes".

(Vela VKE, 2011).

Clearly, there are limited opportunities to pursue conventional solutions to traffic problems, i.e. capacity expansion.

The town's traffic problems are the result of a concentrated set of destinations (the University, schools, workplaces etc.) coupled with a high dependence on the private car

amongst those trying to access these destinations (Van der Merwe, 2011a). As a result of the trends described above, the town is rapidly realising the limits of a growth path dependent on the private car, as the Municipality's Transport Manager argues:

"…this town wants to grow, there are a lot of developments that would like to be here, where? In the centre of town? We can't handle it from a transport point of view [sic]".

(Van der Merwe, 2011a).

Furthermore, it became apparent during the course of this research that the problem of congestion/traffic is the focus of the majority of transport decision makers in Stellenbosch. Typical of this approach was the opinion of the Municipality's former Head of Roads and Stormwater, who suggested to me that congestion is a great source of pressure for action, but that it is difficult and expensive to increase lanes and upgrade infrastructure to ease the problem (Keyser, 2011). I will return to this subject later in this chapter.

Like other urban areas around the world, Stellenbosch faces the challenge of distributing limited urban space amongst different modes of transport:

"With NMT being a priority mode of transport for the majority of people in Stellenbosch, the environmental capacity of many roads have already been exceeded making it difficult for pedestrians and cyclists to move along certain routes and crossing roads. The focus needs to be shifted from the private vehicle to NMT and public transport as wells as the integration of these two modes".

(ARUP, 2007: 7).

Stellenbosch has great potential to enhance the role of non-motorised modes in its transport system (Gordge, 2011) but, as will be discussed later, there are several factors undermining this inherent potential, including urban sprawl, increasing traffic and car-orientated urban/street design.

Figure 4.4 and 4.5 Pedestrian friendly infrastructure in Stellenbosch

Source: Google

Source: The author

Scarce public and pedestrian space in the town is continually threatened by the high demand for space by cars. For example, when the University is in session "vehicles (are) parked legally and illegally on every available piece of land" (Vela VKE, 2011). Moving around town as a pedestrian is increasingly difficult due to high levels of traffic and a network of roads designed primarily for the car (ARUP, 2007). The car is omnipresent in the streets, parking lots and public spaces of Stellenbosch. As a result, Stellenbosch shows many of the characteristics of an "invaded" city as described by Gehl & Gemzøe (2006) in Chapter 2.

Simultaneously, there have been limited efforts to enhance infrastructure for cyclists. According to the Municipality's Director of Engineering Services, the roll-out of bicycle lanes in Stellenbosch is difficult due to narrow streets, the historic roadside water furrows and old oak trees (Van Niekerk, 2011).

Mr Van Niekerk specifically referred to the case of Van Riebeeck Street, a narrow, heavily trafficked street in the centre of the town. Others interviewed for this research project also referred to Van Riebeeck Street as being dangerous and unsuitable for cyclists (Venter, 2011; Winter & Groenewald, 2011). The following quote from the Municipality's traffic engineers is indicative in this regard:

"…if you drive with a bicycle in Van Riebeck Street you take your life into your own hands [sic]".

(Winter & Groenewald, 2011).

In such a situation, an alternative is to slow down car traffic, by reducing the speed limit and/or introducing traffic calming, so that the road can be shared safely by both car and

bicycle (Hamilton-Baillie; 2008). However, Mr Van Niekerk argues that such measures may result in complaints from car drivers and are, therefore, not supported (Van Niekerk, 2011).

While Van Riebeeck Street may be too narrow for bicycle lanes, it is only so because the road is used by cars. If there were no cars on the road, it would be a safe cycleway. The priority given to car traffic and the demands, perceived or otherwise, of the middle class car driver reinforces the existing unsustainable regime.

Where cycling infrastructure has been developed in Stellenbosch, it is often of poor quality. The SRA (Stellenbosch Ratepayers Association) has made the following statement in this regard:

"The SRA also wishes to point out that indifferent building methods used on many NMT routes, coupled with a lack of maintenance, have effectively sabotaged efforts to encourage people to use them".

(SRA, 2011b).

From the discussion above, it is clear that Stellenbosch faces a number of transport problems. While the town has the potential to significantly enhance the role of NMT, little has been one to achieve this. Simultaneously, traffic and parking problems continue to worsen, degrading the quality of public space and the safety/convenience of NMT. And finally, Stellenbosch clearly reflects the inequitable transport dynamics that are present throughout South Africa.

One of the chief role-players in the Stellenbosch transport dynamic is the Municipal transport department, which is the subject of the following section.

4.2.3 Stellenbosch Transport Department

"We, at the present moment, don't even have enough money to maintain the roads, we've got a backlog of R93 million to put all our roads in a position where there is an acceptable standard [sic]".

(Van der Merwe, 2011a).

Within the Stellenbosch Municipal Directorate of Engineering Services is the Transport Department (officially the Transport, Roads and Stormwater Department). As will become clear in this section, within the Department there are divergent approaches to the issue of urban transport. However, it is clear that a conventional car-centric approach to transport is dominant, both in the daily work of the Department and in the approach of its staff. While Stellenbosch transport policy (see the next section) does emphasize green modes of transport, it is clear that the focus of the Department in its day to day operations remains on roads/traffic infrastructure and maintenance. The role of the department within the broader dynamic the "system of automobility" will be addressed in Chapter 5. I will now proceed to provide an overview of the work and approaches of the Department in question.

According to its Manager, Angelika van der Merwe, the Department's priority is road maintenance (Van der Merwe, 2011b):

"Why I also myself only concentrate or concentrate more on…maintenance and rehabilitation…and using the limited budget is because that makes an asset worth less every year to rebuild that and it's also not just only an asset for vehicles it's an asset for a cyclist

and for a bus and for a taxi. So that is one of the main focuses to get existing assets that we have on an acceptable standard [sic]".

(Van der Merwe, 2011a).

Reflecting this priority, the Department is principally geared towards road maintenance and traffic engineering. The quote at the beginning of this section reflects the limited capacity of the Municipality to satisfactorily address even this issue, let alone broader transport issues such as non-motorised transport. Additionally, the Department's Manager stated that the Department focuses "a lot on immediate, reactive issues" (Van der Merwe, 2011a), for example fixing potholes.

Within the department there is a team of over 100 people working on roads (mostly manual labourers), while traffic engineering has workers who deal with line painting, signs and traffic lights. Public and non-motorised transport has a staff component of one: the Head of Transport and Transport Planning, a post which was, until recently, vacant for a year (Fullard, 2011; Winter & Groenewald, 2011). This reflects the fact that the Municipality has neither the capacity nor the funds, at this stage, to operate or administer a public transport system or embark on the large scale expansion of NMT infrastructure (Gordge, 2011; Venter, 2011).

The Municipality's Transport Manager accepts that a priority focus on road infrastructure will not resolve the transport problems facing Stellenbosch. However, she argues that, at present, the Department is simply not geared towards implementing innovative policies:

"And we've got a lot of issues, transport issues, and a lot of stuff that becomes larger because nothing gets done…but we only focus on the money side because that's infrastructure, and you do and you provide and you tend to the problem, which is actually contradictory to being sustainable [sic]".

(Van der Merwe, 2011).

She goes on to argue that, from an economic perspective, it is important that the traffic system works relatively efficiently:

"[There are] very rich people living here and, possibly, working here. I think some of the major companies are situated in Stellenbosch. So, obviously, you want it conducive for that type of economics to be going on here and transport is one of the major issues to attract people [sic]".

(Van der Merwe, 2011a).

However, as I discussed in Chapter 2, taking steps to ensure acceptable car mobility has the potential to cause dysfunction within the urban economy in the long term, and, in the context of extremely limited resources, distracts from enhancing more sustainable modes of transport. I will expand on this analysis in Chapter 5.

During the course of this research project, I also spoke to the Municipal Head of Traffic Engineering, Nigel Winter, and he informed me of the nature of his work. According to him the traffic engineering section focuses on the "maintenance of all road markings and traffic signs" (Winter & Groenewald, 2011), responding to complaints from Municipal residents, altering traffic light programmes to improve the flow of vehicular traffic and installing new traffic calming infrastructure in dangerous locations. According to Mr Winter, the

Department receives a large number of complaints regarding traffic engineering from the public on a daily basis, which have to be addressed (Winter & Groenewald, 2011).

Mr Winter also discussed the traffic problems in the town. He maintained that dealing with the rising level of traffic in the town was difficult, given the obstacles to widening roads:

"To accommodate more cars it automatically implies that we have to get rid of all our oak trees and historical millstreams and stuff like that, to widen our roads to accommodate more vehicles but that is not going to happen. The trees will stay, the millstream will stay. So we have no other option but to cope with the current width of our roads [sic]".

(Winter & Groenewald, 2011).

In chapter 2, I discussed the conventional "predict and provide" approach to traffic, and the problems with this paradigm. In Stellenbosch, it seems clear that the obstacles to road expansion, mentioned in the above quote, are forcing decision makers to depart from the conventional "predict and provide" mentality, which has been so successful in reproducing car dominance around the world (Kenworthy, 2007; Wilkinson, 2008). It is also clear that an over-dependence on the car to meet the mobility needs of the Stellenbosch elite is rapidly revealing the limits of car-orientated development. The limited capacity of the Stellenbosch road network has been reached, and with no viable alternatives available, it can convincingly be argued that the Stellenbosch transport system in fast approaching a point of crisis. I will return to this issue in the discussion on the Eikestad Mall later in this chapter.

Mr Winter went on to argue that, in principle, he was in favour of enhancing pedestrian infrastructure and implementing other measures, such as reduced speed limits, in the historic core of Stellenbosch. However, he argued that this would only be possible if traffic levels in the historic core were significantly reduced, perhaps through the introduction of a park and ride system. In the absence of such a system, he expressed his opposition to measures designed to improve conditions for pedestrians and cyclists, which would have the effect of undermining car mobility and worsening the already problematic traffic conditions even further:

"…you will reduce the mobility to get vehicles out of the CBD, and the idea is basically during the peak hours (AM or PM) or midday, to get your vehicles out of town as quickly as possible" [sic].

(Winter & Groenewald, 2011).

This is a clear example of how the overriding need to cater for cars undermines efforts to create a safer environment for NMT users. Reducing the speed of vehicles is opposed by traffic engineering officials due to the implications for traffic congestion. Effectively the identified priority of getting "vehicles out of town as quickly as possible" supersedes a concern for the safety of NMT users, who would undoubtedly benefit from a slow-speed urban environment (see Chapter 2).

During the course of this research I also met with the Municipality's newly appointed Head of Roads and Stormwater, Johan Fullard. He stated that his work focussed on road maintenance/rehabilitation, fixing potholes and other pavement problems and responding to complaints from the public (Fullard, 2011). Mr Fullard maintained that he favours traditional, 'tried and trusted' methods and approaches:

"We like to stick to the traditional approach on how we do the work, traditional guidelines, we have found when you take something new, new things or new technologies, we have a problem [sic]".

(Fullard, 2011).

An example of this is in road design, where all Municipal roads are designed with a standard speed of 60 kph. This is illustrative of one of the central problems in sustainable transport, that roads and urban spaces are primarily for cars and their inhumane high speeds. As I discussed in Chapter 2, there is little justification for this reality, especially in a place where the majority of people are not car drivers. Given that the traditional (i.e. conventional) approach to urban transport has aided in the development of a car dominated urban environment in Stellenbosch, it is clear that a new approach is required.

Both the Municipality's newly appointed Head of Transport and Transport Planning and the Municipal Head of Spatial Planning, Heritage and Environment display approaches which depart from a car-orientated paradigm.

The Head of Transport and Transport Planning, Melanie Venter, holds a Master's degree in Transport Studies from the University of Cape Town (UCT), a programme which has a strong focus on public and non-motorised transport (CFTS, 2011). She is broadly supportive of enhancing the NMT environment in the town and she is in favour of lower speed limits and fewer cars. When interviewed, it was clear that her primary consideration was on getting people out of their cars, speaking at length about how to get people to drive less:

"Difficult to get people to change the way they travel, to get people out of cars and onto other modes of transport [sic]".

(Venter, 2011).

However, along with others transport officials within the Municipality, this focus on drivers and their problems, distracts from the broader transport issues facing the majority of Stellenbosch residents. Improving the conditions for public and non-motorised transport should not simply be about getting car drivers to drive less and, consequently, resolving traffic problems. Rather, limited public resources should be devoted to transport projects which enhance the mobility and access of the poor (Vasconcellos, 2001). Without this explicit focus, policies and programmes orientated towards enhancing public and non-motorised transport may have problematic effects on equity and, more broadly, sustainability (see the discussion regarding the Gautrain earlier in this chapter).

Mrs Venter also discussed the divergent approaches to transport within the Municipal Transport Department. In reference to the traffic engineers, she argued that their focus is safeguarding car mobility:

"They're more from the traffic side; they just want the vehicles to flow [sic]".

(Venter, 2011).

As a department focussed primarily on road maintenance and traffic issues, it seems clear that the attitudes and daily work of the Department continue to prioritise car mobility.

The town's Head of Spatial Planning, Heritage and Environment is particularly critical of the Municipality's transport department, reflecting the socio-technical divisions alluded to in Chapter 2 and 3.

"My conclusion at the end of the day through my experience in the Municipality is that, don't involve engineers in anything. Engineers seem to try to be too realistic and too set on applying standards, irrespective if that standards comes from 1770. You can't deviate from a standard. You ask them why? And they say 'why do you ask a stupid question like that?' [sic]".

(De le Bat, 2011a).

The above quote is illustrative of the significant difference in the way transport is approached by planning and transport officials within the Municipality. According to Mr De le Bat, the town's transport officials are "not interested" in protecting and enhancing NMT in the town:

"If you took NMT seriously you would protect the little bit that we have and make sure that people can use it" [sic].

(De le Bat, 2011a).

The following case illustrates this point. The University Theology building is located in Dorp Street. In front of the building there is an unpaved area running along the street which is used as a walkway by pedestrians and also used as an informal parking space for cars. Municipal transport officials sought to formalise this parking:

"…we did investigate, we compiled some drawings and estimates of actually building parking there…was intended to formalise the parking that occurs there now" [sic].

(Winter & Groenewald, 2011).

However, Municipal planning officials were strongly opposed to the project which would remove space for pedestrians in favour of the car. The planning department would prefer that bollards were installed to prevent the area from being used for parking and so protect valuable pedestrian space. Mr De le Bat argues that this represents a failure on the part of Municipal transport officials to adequately consider the long term implications of devoting scarce urban space to the car:

"They (transport officials) react in a practical way, thinking short term, trying to solve the immediate problem. If the short term solution is not furthering the long term goal (then) don't approve it [sic]".

(De le Bat, 2011a).

Ultimately, the project did not go ahead due to the objections of the planning department:

"…it was not supported by our planning department specifically from a heritage and aesthetical point of view. It was not supported [sic]".

(Winter & Groenewald, 2011).

Clearly, socio-technical divisions between departments within the Municipality are a reality. This conflict reflects the broader competition for scarce urban space between different modes of transport (Vasconcellos, 2001).

From this overview it is clear that the Stellenbosch Municipal transport department is geared primarily towards road maintenance and traffic engineering. The strict adherence to car-centric engineering standards and the prioritisation of car mobility ensure that the

department assists in the perpetuation of an unsustainable, car-orientated system. Despite this, official Municipal transport policy supports an expanded role for green modes. I will now briefly explore the transport policies developed by the Municipality in recent times.

4.2.4 Transport policies and plans in Stellenbosch

Both the University and the Municipality have now begun to respond to the growing transport problems in the town. The Municipality developed a town transport master plan or interim transport plan (2007), initially under the auspices of the planning department. More recently, this year (2011), a Comprehensive Integrated Transport Plan was produced. The Municipality also has a non-motorised transport network plan and a public transport operations plan.

The University, on the other hand, has developed a Mobility Plan. Both the University and the Municipality have appointed the same consultant, Vela VKE, to draft their most recent strategies. The approach of the consultancy is to focus on developing integrated transport solutions rather than simply expanding roads and parking, as its Technical Director explains:

"I think you need to have a systems approach, an integrated approach, where you can't just have one solution [sic]".

"Sustainable, what we see, is that it's a system approach, promoting what you want to promote but still looking at the realism of yes there is a traffic problem [sic]".

(Basson, 2011).

4.2.5 Municipal transport policy

Two important Stellenbosch transport documents are the *Stellenbosch Interim Transport Plan*, completed by ARUP consultants in 2007, and the *Comprehensive Integrated Transport Plan*, completed by Vela VKE consultants in 2011.

4.2.6 Comprehensive Integrated Transport Plan

As a designated Type 1 authority, Stellenbosch, along with the Metros, is required to develop a comprehensive integrated transport plan, with a strong emphasis on enhancing public transport (Basson, 2011; Van der Merwe, 2011a). The Provincial Government funded the development of the Stellenbosch Municipal CITP (Van der Merwe, 2011a). As the title suggests the plan takes an integrated approach and focuses very much on public transport and, to a certain extent, NMT.

The CITP identified the core transport issues of Stellenbosch as being traffic congestion, the impact of the University on transport networks, parking problems and the importance of non-motorised transport for students. Much of detailed project recommendations come from previous transport studies done for the Municipality including the following:

- Stellenbosch non-motorised transport network plan (SSI)
- Stellenbosch Transport Model (Jeffares and Green)
- Stellenbosch Public Transport Operations Plan (Jeffares and Green)

Additionally, there is a strong focus on the University Mobility Plan, which I will discuss later.

As mentioned above the primary focus of the CITP is the enhancement of public transport in the town:

"The ultimate TDM (transport demand management) measure would be the introduction of its own public transport services as envisaged some time after 2012. Such scheduled services in conjunction with the US services can have a serious positive impact on the Stellenbosch town's levels of traffic congestion".

(Vela VKE, 2011: 35).

4.2.7 Interim Transport Plan

ARUP originally completed a transport master plan for the town in 2004, as part of the development of a Growth Management Strategy. However, the plan was not approved by council. In 2005 the town applied for funding from national government to enhance public and non-motorised transport infrastructure in preparation for the World Cup of 2010 through the Public Transport Infrastructure and Systems Fund (PTIF). The town was allocated R20 million by national government. In addition, the Provincial Government "pledged R8million" (ARUP, 2007: i) to this initiative. The projects that formed part of this application stemmed from the original master plan of 2004. To spend this money the town needed an approved transport master plan. Therefore, the earlier plan was updated by ARUP and adopted by council becoming the town's Interim Transport Plan (ARUP, 2007). The following extract gives some idea of the motivation behind this process:

"Funding through the PTIF presents a unique opportunity for the town of Stellenbosch to now capitalise on such support and aim towards becoming a national example of sustainable transport practice and achieve a net gain in the quality and provision of public transport and non-motorised transport provision".

(ARUP, 2007: iv).

Unfortunately, this "unique opportunity" was not used to radically transform the Stellenbosch transport system, and the unsustainable trends identified in 2004 (rising traffic levels, growing urban sprawl etc.) continue to this day.

The original transport master plan was developed under the auspices of the planning department. The terms of reference demanded a "focus on non-motorised transport and public transport" (De le Bat, 2011d). The master plan is a document which appears to embrace the tenets of sustainable transport. It includes a number of projects designed to reduce the dominance of the car in Stellenbosch and to enhance public and non-motorised transport. An extract from the vision is illustrative of this:

"If the transport system is planned and designed to ensure access to opportunities, choice of mobility, and infrastructure that enhances the social, economic and natural environments, then Stellenbosch will be on its way to achieving sustainable development in its broadest sense".

(ARUP, 2007: ii).

This process was driven by the towns current Head of Spatial Planning, Heritage and Development, who is a staunch supporter of sustainable transport and the creation of quality urban environments. He admits to being "anti-car" (De le Bat, 2011a).

The basic premise of the master plan was to reduce traffic and enhance the urban environment of Stellenbosch by:

- creating a park and ride system
- pedestrianising certain streets
- expanding NMT infrastructure and
- establishing a quality public transport system

The document places particular emphasis on creating quality or "complete" streets within the town:

"Streets are a public asset, of greater use than simply accommodating movement of people and goods".

(ARUP, 2007: 7).

"This should include changes to the geometric design of roads to make walking and cycling as safe, convenient and enjoyable as possible".

(ARUP, 2007: 6).

While many of projects and ideas within the interim plan (2007) date back to the original transport master plan of 2004, few have been implemented. The town does not have a park and ride system, no additional streets have been pedestrianised, little improvement has been made to cycling infrastructure and mini-bus taxis remain the only road-based public transport system in the town.

To illustrate this lack of implementation I will explore some of the most important NMT initiatives in the plan later in this chapter. These will include the:

- "Pedestrianisation of Church and Andringa Street in the Core of the Town Centre"
- "Pedestrian and Cycle Path Infrastructure linking Kayamandi with the Town Centre"

(ARUP, 2007: vi)

From the above overview of Municipal transport policy, it is evident that Stellenbosch transport policy is expressly orientated towards creating a more balanced urban transport system and greatly expanding the role of public and non-motorised transport. However, as will be evident by the end of this chapter, the efforts of the Municipality have failed to re-orient the Stellenbosch transport system away from car dominance.

In section 4.2.2 I provided an overview of the Stellenbosch transport system. In the next section I will explore the issue of urban sprawl in the town.

4.2.8 Continued sprawl

"Low density residential sprawl has resulted in the rapid consumption of land, placing pressure on valuable agricultural areas and natural resources and resulting in traffic congestion and lowered town densities".

(CNdV Africa, 2010a: 106).

As the above quote make clear, one of the most critical threats to the sustainability of the Stellenbosch transport system is the continued outward sprawl that is occurring there. In the 1960s the town began to develop car-orientated suburbs, i.e. suburbs that could only be reached conveniently via car, as the following quote illustrates:

"…curvilinear car orientated large plots layouts in 1960s – 1980s, Cloetesville, Uniepark, Brandwacht, Paradyskloof, De Boord and Onderpapegaaiberg".

(CNdV Africa, 2010a: 68).

The effect of urban sprawl on travel patterns is clearly reflected in the data. High income residents of *central* Stellenbosch undertake 26% of trips using NMT, while for those residing in peripheral suburbs the figures are between 2% and 6%. Low income suburbs report an NMT usage of between 13% and 27%. Again, this varies with distance with those living closest to the centre of town having the highest level of NMT usage (Vela VKE, 2011). This shows the important role of urban form, and short distances, in promoting and safeguarding the role of NMT (Banister, 2008).

It stands to reason that middle/upper class suburbs developed on the outskirts of town will only increase the level of traffic entering the town each day:

"Stellenbosch town whose outer suburbs' layout generates considerable private motor vehicle travel demand especially from the southern, western and eastern part of the town. This has now resulted in severe traffic congestion in the morning and evening peaks on the roads into the town".

(CNdV Africa, 2010: 35).

In recent times this trend has worsened with the development of gated communities, shopping centres and isolated business parks (Technopark) on the periphery of the town which are entirely car dependent (CNdV Africa, 2010a):

"*Over many years, Stellenbosch has developed from a compact university town, to a dispersed and disjointed pattern of residential settlements, employment hubs and decentralized commercial activities. Most of these are focused on the Provincial main road system, and little or no attempts have been made to integrate these new developments with the town itself*".

(Vela VKE, 2011).

According the Municipality's Head of Spatial Planning, Heritage and Environment there is a lot of pressure on his office for growth and outward expansion (De le Bat, 2011b)

The zoning of certain areas for single uses, residential for example, has further aggravated the situation in Stellenbosch by separating homes, schools, places of education and retail outlets, encouraging urban movement by car (CNdV Africa, 2010a).

According to Municipality's head of spatial planning, the draft SDF seeks to rectify this problem by enforcing an urban edge and creating mixed use, walkable, contained nodes throughout town, eventually connected by public transport. This would allow people to access all the necessities within their area or in other areas via public transport, rather than having to travel to other parts of town by car (De le Bat, 2011a). However, Stellenbosch is clearly far from reaching this ideal.

While urban sprawl is a reality in Stellenbosch, there has also been a strong trend of increasing density in the centre of Stellenbosch through the redevelopment of existing sites. This process is driven chiefly by the strong demand for student accommodation (CNdV Africa, 2010a).

One, oft cited, example of sprawl in Stellenbosch is De Zalze, an upmarket golf estate on the outskirts of Stellenbosch (see figure 4.6 below).

De Zalze is a large, low density, upper income residential estate completely separated from the broader urban fabric of Stellenbosch. It is described by Pam Golding estate agents as follows:

"The 300ha De Zalze Winelands and Golf Estate is located on the eastern fringe of Stellenbosch and provides the town with its most prestigious residential precinct".

(Pam Golding, 2011c).

Figure 4.6 De Zalze

Source:Chris Jacobs and Arcus Gibbs

From a transport perspective, the residents of this development are completely dependent on the car. To access schools, workplaces, shops and other amenities, residents of this estate must drive. Walking and cycling are unfeasible due the distance of the estate from town and the fact that the main road connecting it to town is a high speed motorway, not safe for non-motorised travel. Also, low income individuals who work at the estate must now use either poor quality NMT of PT to access the estate. Therefore this kind of development supports a car dependent lifestyle for the rich and makes life more difficult for those without access to a car (CNdV Africa, 2011a; De le Bat, 2011a)

Figure 4.7 Stellenbosch Square shopping centre – a classic 'auto-social formation'

Source:Chris Jacobs and Arcus Gibbs

Stellenbosch Square, a shopping centre, was developed across the R44 (on the right of Figure 4.7) from De Zalze. It is a classic case of car-orientated design. Its development was opposed by the Stellenbosch Municipality:

"Neither De Zalze, as an out of town golf course estate, nor the Stellenbosch Square out of town shopping centre have formed part of planning policy for the municipality at either provincial or municipal level, hence their approvals via appeals to the premier".

(CNdV Africa, 2011b).

Phase 2 of De Zalze project, named Stellenbosch Winelands Estate is currently being pursued by developers. It will involve an additional 150 sites on 30ha of land. The unsustainable transport implications of this type of development are illustrated by the following comments in the traffic impact study (TIS) carried out for the development:

"It is also anticipated that, due to its location and nature, the development will not be a significant non-motorised trip generator, consequently no special arrangements to accommodate non-motorised transport are considered necessary".

"Given the type and location of the development, the estimated number of new public transport users generated by the development is considered to be insignificant during the peak hours".

"The employees and staff however, will make use of public transport".

(Aurecon, 2009: 15).

Clearly, future residents of this proposed estate will be car-dependent while those who work at the estate in low paid positions will be forced to travel further using poor quality public or non-motorised transport.

There are many other examples of continuing low density sprawl in Stellenbosch, notably the Longlands residential estate, consisting of 100 homes (See figure 4.8 below). Pam Golding estate agents describe the development as follows:

"Longlands Country Estate offers the tranquillity of authentic country living with all the modern conveniences close by. Accessibility is the keyword at Longlands - the world-renowned historical town of Stellenbosch is less than 10 minutes' drive away, offering easy access to shopping centres, schools and a university".

(Pam Golding, 2011b).

"Longlands Country Estate is ideally situated 7 km from the centre of Stellenbosch on the M12. This idyllic location puts it within easy access to all amenities and infrastructure offered by a modern city such as various shopping centres, award-winning wineries and restaurants, as well as schools and a university".

(Pam Golding, 2011b).

This type of development is heavily dependent on the private car for its viability. The distance from town and the lack of quality public and non-motorised transport alternatives suggest that anyone living there would be entirely car dependent. Additionally, it increases the distance between important locations within the Municipal area.

The "Longlands commercial component" is planned for the site across the road from Longlands in order to service the residents (Withers, 2011b). One development seems to follow another, as was the case with De Zalze and Stellenbosch Square shopping centre. Not only does this solidify sprawl and car-dependent ways of life it also results in greater hardship for low income residents, who struggle with poor quality public transport or dangerous non-motorised transport to move between these new parts of Stellenbosch designed principally for the car.

Figure 4.8 The construction of Longlands Estate, currently underway

Source: longlands.co.za

Clearly, continued urban sprawl in Stellenbosch has implications for the town's transport system. The car-orientated nature of this sprawl is reshaping the town, creating an environment in which car mobility is necessary for effective participation in society. Some of the features of Stellenbosch which provide an opportune platform for sustainable transport transition, such as its compact walkability, are undermined by the processes described above. This process is driven by private sector interests, and despite opposition from some

quarters in the Municipality, local government seems unwilling or unable to curtail sprawl. In the next section of this chapter, I will explore the case of the Eikestad Mall which highlights the limits of car dependent growth in Stellenbosch.

4.2.9 Eikestad Mall

"Eikestad Mall is becoming quite a problem for us".

(Winter & Groenewald, 2011).

The Eikestad Mall is a large R1 Billion urban regeneration project in the historic core of Stellenbosch. It involves the upgrading and expansion of the existing Mall and the redevelopment of the surrounding buildings. The development will be of mixed use with office, residential, leisure and retail components. It is described by the developer as follows:

"The historic core of Stellenbosch is finally getting the fresh start it deserves. The transformation will offer an array of specialised stores and restaurants, as well as create outstanding office space and residential units. Take advantage of this opportunity to experience ideal location, hassle free access, ample parking, a tranquil atmosphere and breathtaking views".

(Abacus, 2011).

The development will include over 1000 parking bays, providing the "ample parking" alluded to above. However, the likely contribution of this development to traffic congestion in the town suggests that the "hassle free access" mentioned above, may fail to materialise:

"…[the mall development is] adding new floor space which is going to generate addition trips and adding 1000 new parking bays, supply which will increase demand, which is going to increase the traffic. The infrastructure can't cope with more trips. [sic]".

(De le Bat, 2011a).

This development project is highly contested. The streets around the site are already congested during peak hours and the redevelopment project will exacerbate this problem, further undermining the quality of the urban environment in the historic core of Stellenbosch. For example:

"Peak hour weekday PM traffic demand at the Andringa/Victoria intersection will increase from 637 vehicles to 1630 vehicles, an increase of 156%".

(SRA, 2011a).

This intersection (Andringa/Victoria Street) is directly opposite the University campus and experiences a high level of student pedestrian activity. The dramatic increase in car traffic at this location is likely to undermine the pedestrian 'experience'.

At the time of conducting this research the Transport/Traffic Impact Assessment (TIA) for the development, originally submitted in 2008, had not been approved by Municipal transport officials:

"Building plans and the application is not approved due to certain issues and problem areas that we have identified in the TIA…So that development, in principle, is not approved by the Municipality yet. But it's still going ahead [sic]".

(Winter & Groenewald, 2011).

Municipal transport officials objected to the initial TIA for its probable impact on traffic levels and its failure to adequately examine public and non-motorised transport matters (Stellenbosch Municipality, 2010). A later version of the TIA, submitted in 2010, did include proposals to construct a secure bicycle parking station (Van der Merwe, 2011b).

The redevelopment of the Mall will require an upgrade in adjacent road infrastructure to cope with increased traffic volumes. At the time of this research, there was disagreement and continued negotiations between the Municipality and the developers regarding the specifics of these infrastructure upgrades (Van der Merwe, 2011a; Winter & Groenewald, 2011). However, Municipal planning officials regard such upgrades as problematic. According to Mr De le Bat, the upgrades required to accommodate the increased level of traffic will further undermine the quality of public space within the historic core and undermine the conditions for both pedestrians and cyclists (De le Bat, 2011a and 2011d):

"It's 180 degrees against the vision of the town, the pedestrian kind of vision of the town, it will create serious problems [sic]".

(De le Bat, 2011d).

The Stellenbosch Ratepayers Associations has recommended that the Municipality:

"…rejects the Arup TIS in its entirety as being too subjective, limited in scope, and ignorant of the town's SDF and NMT visions".

(SRA, 2011a).

At the same time, the developers are upgrading the existing pedestrian street that runs through the development (Beyers Street) and plan to implement a more pedestrian friendly design on Andringa Street, which runs next to the development (Winter & Groenewald, 2011).

The Eikestad Mall development highlights the problems of a car dependent growth path. In order to be successful the development requires effective access by car due to a lack of quality alternatives for the middle class. However, the reality is that the roads of Stellenbosch simply cannot handle the additional traffic that will be generated without a detrimental effect on the urban environment:

"Resulting in the end of the day in the design of the public space which is totally car-oriented [sic]".

(De le Bat, 2011a).

Although the Mall development is going ahead, this issue highlights the limits of car dependent development. Furthermore, this is a private sector development which is going ahead despite resistance from the Municipality. The discussion in the previous section, on urban sprawl, also highlighted the inability or unwillingness to direct urban development in a sustainable direction. The next section of this chapter will explore the case of Church Street.

4.2.10 Church Street

In Stellenbosch the primary battle for the reconquering of public space from the car is centred on Church Street and the historic core of Stellenbosch, where a debate continues about whether or not to create a dramatically enhanced pedestrian environment for the street, in which the car no longer has priority.

Figure 4.9 Church Street, Stellenbosch

Source: Author

Church Street is an attractive street in Stellenbosch. It is lined with cafes, restaurants, oak trees and shops and is an important tourist attraction (see Figure 4.9 above). It is at the heart of the historic core of the town. In an attempt to preserve the historic character of the street, enhance the quality of the public realm and boost non-motorised transport it was proposed in the master plan that the street be pedestrianised and that on street parking be transferred to the Transvalia parking lot on Dorp Street. Church Street does not fulfil an essential function within the road network of the town and therefore its pedestrianisation was considered unlikely to have any significant effect on traffic (ARUP, 2007). Despite this, the project has yet to be implemented.

A portion of the funds received by Stellenbosch Municipality for World Cup transport infrastructure were allocated for the Church Street project. Consultants were appointed and a design was completed: "It was a detailed plan done for implementation, for the purpose of going out on tender" (De le Bat, 2011d). However, the Municipality's political decision makers chose not to go ahead with project due to opposition from members of the community (De le Bat, 2011c, 2011d).

Mr De le Bat, the Municipality's Head of Spatial Planning, Heritage and Environment provides a succinct overview of how the Church Street project unfolded:

"We applied for funding for the closure from national government. They made a lot of funding available for the World Cup, so we applied for funding. Received funding for the closure of Church Street specifically, infrastructure. But council decided not to do it. What they then did is they a appointed a consortium to redo the plan, finalised the plan, spent all

the money on consultants fees and then council decided not to implement for reasons of objections [sic]".

(De le Bat, 2011d).

Paolo Sandri is a prominent local businessman and an exemplar of the opposition to the pedestrian project on Church Street. He owns the restaurant Wijnhuis on Church Street as well as several other buildings on the street. He is deeply opposed to the pedestrianisation of the street and the removal any of the on-street parking. He argues that businesses on the street depend on the easy access that this parking provides for their customers. He asserts that the street is working well and that there is absolutely no reason to change it. Any change to the street, he argues, threatens the livelihoods of the business owners and their employees. Wijnhuis alone employs 50 people. He maintains that business has not been easy of late, partly due to the recession, and that a pedestrianisation project is extremely risky and could potentially drive customers to use choose destinations which are more accessible by car (Sandri, 2011). While these concerns are clearly legitimate, the increasing dysfunction of the Stellenbosch transport system, due to excessive car use and the lack of alternatives, is also a significant threat to the viability of businesses in central Stellenbosch which are dependent on convenient car access.

Furthermore, there was a need for a parking garage in close proximity to Church Street to both replace the parking spaces removed from that street due to the proposed pedestrianisation project and to begin a broader park and ride project for the town. The Municipality owns the Transvalia parking lot (near Church Street) and had sought to create a larger parking garage at this site as part of the Tender 34 process, which involved the private development of strategic municipal owned properties (De le Bat, 2011a).

A tender was put out for the Transvalia site to be developed as a "parking garage and tourist facility" as "a first step towards reclaiming the central area from the motorcar" (Stellenbosch Municipality, 2010: 93):

However, the development proposal put forward by the chosen developer for the site deviated significantly from what was requested in the tender. Later, the Tender 34 process became embroiled in legal challenges and corruption allegations and is still not fully resolved. This has obviously delayed any development on the site and prevented the construction of a parking/park and ride facility there, which by extension has hindered the Church Street project.

To this day Church Street has not been pedestrianised. Recently, the Municipality has, again, begun to examine the project but they are now focussed on how the entire historic core can be protected and made safer for pedestrians and cyclists. This would potentially involve a mixture of pedestrian friendly treatments including street closures or simply giving pedestrians/bicycles priority over cars on some roads (De le Bat, 2011a).

Andre van Niekerk, Director of Engineering Services for Stellenbosch Municipality, believes that there is now agreement amongst senior Municipal officials and decision makers on the importance of an enhanced pedestrian environment in the historic core of the town (Van Niekerk, 2011). However, Mr De le Bat remains wary:

"I don't always think they realise what they are buying into because if you look at the case studies worldwide you will find that closing off streets takes courage, it's a difficult decision

to make, it's an unpopular decision to make and where it was accepted it was usually attributed to a specific individual who had the guts to stand up for their beliefs [sic]".

(De le Bat, 2011a).

The above case gives an indication of the practical difficulty involved in reclaiming space from the car. The failure to implement proposed sustainable transport projects in Stellenbosch is one factor inhibiting the transition to a more sustainable transport system. Upgrading the NMT connection between Kayamandi and Stellenbosch was also an important component of the interim transport plan, as the case of Bird Street makes clear.

4.2.11 Bird Street

There are a number of locations in Stellenbosch where the demands of cars for space and mobility undermine the safety and quality of non-motorised transport. Bird Street is one such example.

Bird Street (see Figure 4.10 below) is one of the busiest pedestrian routes in town, serving as the primary pedestrian link between the low income suburb of Kayamandi and the town centre. The town transport master plan recommended an upgrade to this route in order to strengthen the integration between Kayamandi and the centre of Stellenbosch. Bird Street is also a very busy, traffic clogged street. It is relatively narrow, has an inadequate number of pedestrian crossings and has multiple oncoming streets acting as obstacles to movement of pedestrians along the street (Roux, 2010):

"Walkway widths were witnessed to be too narrow to accommodate pedestrians and shared cyclist use, having the effect that cyclists have to share the road with vehicles. Little effort has been made to minimize the interaction pedestrian's encounter with traffic along these walkways".

(Roux, 2010: 63).

As a result, conflict between pedestrians and motorists is frequent, with many pedestrians choosing to jaywalk rather than use designated crossing points. Cyclists also use this route despite the fact that is extremely dangerous (Roux, 2010; Venter, 2011).

Bird Street is the most dangerous street in Stellenbosch according to road accident statistics, with 497 accidents between 2005 – 2010. Merriman Street is in second place with 271 accidents between 2005 – 2010 (Vela VKE, 2011).

Despite this, the town's transport engineers believe there are too many pedestrian crossings on Bird Street and in the CBD in general (Winter & Groenewald, 2011). As discussed in section 4.2.3, they are primarily concerned with the effect this has on traffic flow. They argue that reducing the number of pedestrian crossings will "improve the mobility of the vehicles… because there are so many pedestrian crossings in the centre, in the CBD, that is also a cause of traffic jams and backup [*sic*]" (Winter and Groenewald, 2011).

The traffic engineers believe that pedestrians need to be educated to use the existing formal pedestrian crossings and to use them correctly (Winter & Groenewald, 2011). The pedestrian infrastructure is currently receiving a R3, 7 million upgrade, involving the "upgrading of sidewalks and landscaping" of the street (Engineering Services, 2011). This project will essentially create a "uniform sidewalk all along [*sic*]" (Venter, 2011). However, the original idea was broader:

"That (sidewalk upgrading) wasn't the idea, the idea was to see if there was not space in places for all sorts of activities that goes hand in hand with pedestrian movement".

(De le Bat, 2011a).

Figure 4.10 Bird Street, a place of heavy pedestrian and motor vehicle traffic

Source: Google

According to Johan Basson of Vela VKE, the inclusion of bicycle lanes in the project was rejected by the Municipality's transport department due to its cost (Basson, 2011).

Bird Street is clear example of the difficulty in resolving the competing demands of pedestrians, cyclists and motorists for scarce urban space. Currently, the road is designed primarily for the movement of cars. As a result it is unsafe for pedestrians and cyclists. There is little doubt that the lives of low-income residents of Kayamandi would be enhanced if Bird Street was radically reshaped to create a safer pedestrian/cyclist space but, it is clear that the town's traffic engineers prioritise car mobility over pedestrian safety and convenience. There is little desire to effect such a radical reshaping. Indeed, the current infrastructure is deemed overly generous in its provision for pedestrians. Such an approach helps to perpetuate a car-orientated system in which the middle class thrive and the poor suffer. These views are an important barrier to the transition to a sustainable transport system. In the next section I will discuss other barriers to Municipal transport activities.

4.2.12 Barriers to progress for the Municipality

"…we should have a cycle network for the whole of Stellenbosch. At least the flat part. And the historic core should be a pedestrian and cycle priority area. It's not happening partly because there is not the money and partly because there hasn't been the political will by the majority of any ruling party [sic]".

(Botha, 2011).

As the above illustrates, there are a number of barriers to transport system change in Stellenbosch.

As mentioned earlier in this chapter, transport improvements driven by the Municipality are hindered, by amongst other things, limited capacity and financial resources being available for transport. In addition, the Municipality has several competing priorities to which it devotes the majority of resources. In this context there is little money for NMT enhancement as it is not seen as an urgent priority. The following quote from the Municipality's Transport Manager illustrates this point:

"Municipal budgets are limited and focuses on sewerage and provision of potable water and having maintainable roads, obviously the last thing in the row will be upgrades for NMT because that is also very costly [sic]".

(Van der Merwe, 2011a).

Additionally, the Director of Engineering Services argues that Stellenbosch Municipality currently does not have the funds or the capacity to run a bus service and therefore, he argued, that the Municipality was looking towards the University to act first, on the matter of public transport (Van Niekerk, 2011).

Additionally, the Municipality's Transport Manager has insisted that the Municipality simply does not have the money to construct a park and ride facility itself, "we depend on private funding to get something like that going, there's no way that this Municipality will be able to fund it [sic]" (Van der Merwe, 2011a.

The Head of Traffic Engineering also suggested to me that a lack of finances was one of the biggest obstacles to his work (Winter & Groenwald, 2011), as well as objections and opposition for a very vocal public:

"On the one hand we do our studies, the measures are warranted, we want to put it in, we want to improve traffic flow and then once you get started and you get buy in of the people in that facility…you get bombarded with people that will always come to you and say to you "why were we not informed of this". That is people normally from the other side of town and they will come with historical and aesthetic barriers [sic]".

(Winter &Groenewald, 2011).

Richard Gordge (2011), a sustainable transport consultant residing in Stellenbosch argues that the National Land Transport Act (mentioned earlier in this chapter) was a "ray of hope" for local transport control. It devolved responsibility for transport to the local level but, unfortunately this has not been accompanied by a sustainable funding strategy for local government transport reform (Gordge, 2011).

Mr Gordge went on to argue that while Stellenbosch Municipality was drafting a Comprehensive Integrated Transport Plan (CITP) it was not "feeling the heat" to deliver public or non-motorised transport. So, he argues, there is basically money for consulting firms to develop plans "which just goes on and on" and no real change occurs (Gordge, 2011). The Municipality does not have the capacity or funding to actually roll out the proposals contained in the CITP (Gordge, 2011; Van der Merwe, 2011b). Mr Gorge argues that there is still a long way to go institutionally before the issues mentioned above can be resolved and local, non-Metro, Municipalities can begin rolling out sustainably funded public transport systems (Gordge, 2011).

Additionally, the focus, according to Mr Gordge, of national transport decision makers is on the Metro areas, such as Cape Town, which have a much greater capacity to manage large,

complex transport systems than Stellenbosch. Mr Gordge maintains that it is unlikely that National Government would devote significant funds to improving public transport in Stellenbosch. Their priority remains Metros and, particularly, the low-income, high density areas of those metros rather than relatively wealthy emerging cities such as Stellenbosch (Gordge, 2011).

Another barrier to progress is the highly fragmented character of the Stellenbosch transport system, as is the case nationally. Stellenbosch Municipality has to contend with large segments of its transport system over which is has little or no control which makes any kind of co-ordinated change difficult (Basson, 2011; Gordge, 2011). For example, the rail connection between Stellenbosch and Cape Town is operated by PRASA (a national entity) and is not considered a priority for improvement and is therefore likely to remain of poor quality for some time (Vela VKE, 2011 and Basson, 2011). The Municipality's primary transport consultant made the following argument in this regard:

"The Municipality will never be able to implement the plan on their own because you've got such a lot of authorities involved. Rail is run on its own, Provincial roads is run on its own. So they need assistance from all these authorities and National Government [sic]".

(Basson, 2011).

A further barrier to transport system change is the functional integration of Stellenbosch into the broader Cape Town Metropolitan area. As a result of this integration the town's transport system receives a large daily influx of commuters from the surrounding region, over which the Municipality has little control (Vela VKE, 2011):

"Daily migration into and out of Stellenbosch Town for many workers to go and work elsewhere (Cape Town) or middle and lower class workers who cannot afford to stay in Stellenbosch or Franschoek, but have to work there".

(Vela VKE, 2011).

According to the Municipal traffic engineers, there is an epidemic of cars entering Stellenbosch with only one occupant, they estimate that about "80% of incoming traffic has one person inside *[sic]*" (Winter & Groenewald, 2011). Worryingly, this is one of the key features of hyperautomobility as described in Chapter 2. Indeed, it can convincingly be argued that the South Africa middle class displays all the characteristics of hypermobility.

Contributing to this problem is the lack of affordable homes in Stellenbosch. As a result, many people have to drive into Stellenbosch each day because they cannot afford to live in walking distance of their place of work (De le Bat, 2011a; Van der Merwe, 2011a). The following quote from the Municipality's SDF illustrates this point clearly:

"Urban land in most of the urban settlements also commands high prices thereby providing little incentive for social and middle income housing. This results in this part of the market having to live outside the municipality and commute in, mainly to Stellenbosch town, thereby creating a large need for travel and traffic congestion".

(CNdV Africa, 2010: 55).

The significant movement of people in and out of Stellenbosch each day reduces the ability of the town to independently address its transport issues. The poor state of public transport in the region, means that middle class individuals, students and commuters often drive to

Stellenbosch rather than catch a train or a bus exacerbating traffic problems in the town (De le Bat, 2011a; Van der Merwe, 2011a; Vela VKE, 2011).

From the discussion above it is clear that there are a multitude of barriers to progress, particularly on the part of the Municipality. This includes a lack of political leadership, limited capacity and resources to adequately address the transport problems facing the town, competing Municipal priorities, uncertain direction from National government, fragmented institutional responsibility and the negative effects on traffic levels which result from the functional integration of Stellenbosch into the Cape Town Metropole. I will now move on to an exploration of efforts by other role-players to address the town's transport problems, beginning with the University.

4.2.13 The University and transport

"…*they compete with other Universities which might be more accessible so they see these limits and they are trying to address it [sic]".*

(Van der Merwe, 2011a).

The University has recently begun implementing an integrated Mobility Plan developed by Vela VKE consultants in response to the growing parking and traffic problems on campus. The rapid growth of the University, detailed earlier in this chapter, has seen a concomitant rise in student and staff traffic levels, with broader implications for the town as whole. The University does not currently run a public transport system. The central campus area is, however, a relatively pedestrian friendly environment (see Figure 4.12 and 4.13 below). But, it's clear that the conditions for NMT could be significantly improved. For example, figure 4.12 depicts Merriman Street, a busy road, which runs through the University campus, creates a barrier to pedestrian movement and undermines the environmental quality of the campus environmental (BKS, 2005).

"The survey [conducted by BKS consultants as part of a transport study for Stellenbosch University] indicated that 86% of respondents experienced problems with the use of bicycles. The biggest problem from the survey is the lack of bike routes/bike lanes, lack of safe parking, security and conflict with motor traffic".

(BKS, 2006 :27).

Also, the high traffic levels and the epidemic of University students parked on pavements and on every available space close to the central campus undermine the quality of the campus environment (Botha, 2011; De le Bat, 2011a). It is estimated that there is a shortfall of approximately 3, 500 parking spaces for the University population (Vela VKE, 2011).

A survey conducted in 2010 by Vela VKE on the travel habits of Stellenbosch students revealed that 51% of students made use of a private car to access the University as driver, passenger or part of a lift club. Almost 20% of students walked to campus each day, 3% of students cycled to campus, while less than 1% made use of either mini-bus taxis or the train. Additionally, 24% of students reported that they made use of some combination of different transport modes. Almost 95% of the University's personnel/staff made use of the private car to access the University, again as either driver, passenger or part of lift club (Vela VKE, 2011). This survey gives a clear indication of just how car dependent the University is.

Figure 4.11 Merriman Street

Source: Google

Meanwhile, a third of students stay on or very close to the central campus, a third of students stay in the broader Stellenbosch region and the remaining third live in the broader region including Cape Town, Strand and Belville (Vela VKE, 2011). Only those living on or close to campus are likely to walk/cycle to campus and therefore the issue of affordable, well located student accommodation becomes central to the transport debate.

The University's head of Planning and Development, Mr Schalk Opperman, describes the process of developing the University's current Mobility Plan below:

"As the University grew the students became more and more and cars became more and more, as you know, and the parking problems, for instance, became a bigger and bigger problem. We then, had quite a number of discussions over a period of time about the problem, and then myself and my colleagues started thinking about putting together an integrated plan to solve the problem. And that is why we then decided to do a Mobility Study for the campus. Why integrated? Because we realised that there is no single solution. We can't just keep on building parking; land is not available and is scarce. We must also look at other means of alleviating the problem by getting people out of cars and onto public transport, and those kinds of things, which of course doesn't exist [sic]".

(Opperman, 2011).

Simply expanding parking would have proved too costly for the University. The projected cost to expand the Coetzenburg parking area is estimated to be in the region of R125 million (Vela VKA, 2011). Other smaller parking projects are, however, going ahead.

Those involved in this process display a commitment to the concept of integrated transport solutions as the following quote makes clear:

"*You must get people out of cars and into public transport, onto trains, onto bicycles, get them to walk again, those kind of things [sic]".*

(Opperman, 2011).

Figure 4.12 The car-free central campus

Source: Author

According to Mr Opperman, pressure has built on University authorities to address the transport problems on campus (Opperman, 2011). Not only are students complaining about the situation but the traffic/parking problems have increased to an unacceptable level, as the University's transport consultant argues below:

"…you will not be able to carry on indefinitely like this and at the moment, it's not even indefinitely, it's already a problem. You just look at it at the moment [sic]".

(Basson, 2011).

The Mobility plan developed in response to these problems is composed of several parts:

- The creation of peripheral parking lots connected to the central campus by shuttle in order to reduce traffic on the central campus

- A significant improvement in the conditions and facilities for cyclists through the provision of secure bicycle parking, the purchase of bicycles that students can borrow for a year on deposit and the creation of a *woonerf* covering the campus and residences in which pedestrians and cyclists will have priority over cars:

- The creation of a public transport service connecting nearby areas with the town including Strand and Belville.

- The development of a shuttle service for students and staff which will circulate around Stellenbosch during the day connecting the main nodes.

(Basson, 2011; Opperman, 2011; Vela VKE, 2011).

Figure 4.13 Pedestrian friendly campus infrastructure

Source: Google and the author

The ultimate objective of the plan is to get three to four thousand cars off the road, hopefully creating a safer cycling environment in the process (Nel, 2011a). It is hoped that students coming from outside town will use either the public transport system or the park and ride system. Once on the central campus, students would either walk or use a bicycle. In the long term, Mr Opperman would like to see parking removed from the central campus area:

"If we can get that going then we can start to take away all parking in Victoria Street, landscape in front of all our buildings, take away all those cars and then in 30 years' time the campus will be a green parkland with people walking, cycling and sitting around on benches. Not swamped with cars like it is now [sic]".

(Opperman, 2011).

The implementation of the plan has begun, with the first secure bicycle storage facility now open on campus. The University is also in the process of securing 500 commuter bicycles from the Netherlands to loan to students and staff (Opperman, 2011). However, the complete implementation of the integrated plan, including the costly roll out of a public transport system, is dependent on approval by University management. At the time of conducting this research the business plan for the transport system was still being finalised. According to Mr Opperman, funding the system is an issue:

"Funds are always problematic, the University does not have sufficient funding to do everything at once and we have to compete against different priorities to get the funds but we are starting to implement some of the measures [sic]".

(Opperman, 2011).

Previous attempts by Facilities Management to improve NMT infrastructure on the campus were hampered by a lack of funding (Nel, 2011b).

The Municipality views the University shuttle system as, potentially, phase 1 of a broader public transport system serving the whole town. The Municipality's lack of political will, capacity and funding for improving public transport have limited any Municipality led development in this sector, so Mr Opperman argues that:

"…the Municipality are looking at the possible University shuttle service with the view that it could be a "catalyst for a bigger system in town". It is easier for the University to start up something than it is for the Municipality, they have all sorts of political issues and housing and stuff which makes it difficult [sic]".

(Opperman, 2011).

The Municipality's Manager of Roads, Transport and Stormwater believes the University has accepted its responsibility, given its overwhelming contribution to the transport problems faced by the town. She refers to the difference in traffic conditions during the University holidays and, therefore, wonders: "So is there really a need to widen the roads?" (Van der Merwe, 2011a). She believes that the introduction of a University public transport system connecting the outlying areas will have a "big impact on the usage of the roads" (Van der Merwe, 2011a).

The innovative transport plans of the University suggest that it will be a significant role-player in the creation of a more sustainable transport system in Stellenbosch. I now move on to examine other role-players in the Stellenbosch transport dynamic.

4.2.14 The struggle for better non-motorised transport

There several groups and individuals within Stellenbosch which are attempting to improve the conditions for non-motorised transport, including the Stellenbosch Ratepayers Association (SRA), the National Cycling Academy (NCA) and Eco-maties.

The SRA) is one organisation pressuring for change. It frequently makes comments on developments within the town and points out the lack of provision for NMT in those developments. It also lobbies the Municipality to increase the priority and funding for NMT. In 2010, it established a NMT liaison committee to enhance co-operation between the Municipality and the University and to generally promote NMT in the town (Groeneweld, 2011; Reyneke, 2011). Representatives from the Municipality, the University, the SRA, the National Cycling Academy and Vela VKE sit on this committee. According to one member of the committee, "the forum wants people to get out of their motor cars and use NMT and public transport. So it's the total promotion of NMT according to best possible practices [*sic*]" (Lemmer, 2011).

Professor Reyneke is the Chairman of the committee (Reyneke, 2011). He argues that there is no adequate provision for pedestrians and cyclists in Stellenbosch and that vehicular traffic dominates. So the SRA launched an effort to combine "big spenders", i.e. the University and the Municipality, to get them to work together to improve NMT. Historically, he argues, there has been a large degree of independence between planners on both sides. Another member of the committee and of the SRA, Gawie Groeneweld, argues that NMT conditions in the town have not improved because there is not the will to implement existing plans, such as the NMT network plan. He maintains that the SRA would like to see a significant increase in funding for NMT projects, a display of real commitment on the part of the Municipality (Groeneweld, 2011). The SRA has made the following comment in this regard:

"The SRA is of the view that the amounts allocated to NMT in the 2010 through 2013 budgets are wholly inadequate and even derisory. Changing the car-orientated mind-set of local politicians and administrators is an essential first barrier to clear, in order to rectify the under-investment of the past".

(SRA, 2011b).

Another organisation working to improve the conditions for NMT in Stellenbosch is the National Cycling Academy. Specifically, it has been attempting to expand the role of cycling as a mode of transport within Stellenbosch. These efforts have largely been driven by Carinus Lemmer, former CEO of Cycling South Africa, who has been lobbying local decision makers for change. He sits on the NMT liaison committee and has been meeting with and lobbying various role players (Municipal officials, the SRC, University Officials, local corporates and NGOs) to further enhance the conditions for cycling in Stellenbosch (Lemmer, 2011a).

The primary work of the National Cycling Academy is to introduce cycling to students at primary school level, especially those from a disadvantaged background, as Mr Lemmer explains below:

"So a group of us got together and we formed a section 21 company called the National Cycling Academy and our current focus is only getting people onto their bicycles and the way that we do it is by starting in Stellenbosch where most of us are based, where we have access to funding through private and commercial and statutory avenues. We try and find volunteers who help us go to schools particularly in the agri-rural communities close to farms, by working with kids at primary school level. The kids play on bicycles. If they don't have bicycles we provide bicycles for the play sessions. So what we do it that we teach them bicycling through play. We started with fun, and the purpose is to commute. If a 7/10 year old can learn to enjoy a bicycle and learn to be safe on a bicycle by means of playing, so we teach bicycle soccer for example, then we'll probably make him a commuter in a few years' time [sic]".

(Lemmer, 2011a).

The National Cycling Academy works together with the Bicycle Empowerment Network, a Cape Town based NGO which promotes cycling in the poorer communities of that city. BEN has also been involved with developing the cycling component of the Mobility Plan for the University.

Mr Lemmer believes the priority should be on changing attitudes and on educating the residents of Stellenbosch with regards to cycling:

"What our NGO stands for is: let's go educate as is. So we take the conditions as they stand, engineering wise, infrastructure we don't want to change. We want to change people. If we can have an attitudinal shift, in the behaviour in the roads and the streets, then most of our problems will be over. That's my view [sic]".

(Lemmer, 2011a).

Given the limited ability of the Municipality and the University to expand cycling infrastructure, he is focused on practical steps that can rapidly be introduced to improve the conditions for cycling in town. He is supportive of slowing down the speed of traffic within the town itself, as the following quote details:

"Unfortunately, a motorist always has a gun because the car is his gun. So at least take the bullet out his chamber, force him not to have that opportunity of going too fast in limited space".

(Lemmer, 2011).

One of the initiatives of the National Cycling Academy, in association with a number of partners, is the RideLife campaign, which strives to create awareness and pressure for cycling improvements. Mr Gordge, the sustainable transport consultant mentioned earlier in this chapter, is involved in this initiative and describes the idea behind RideLife below:

"…through participation in cycling how could we increase the amount of noise for improvements in cycling – better facilities, safety, general advocacy for cycling. Step 1 is people being out there on their bike. Step 2 is where can this lead to next, i.e. pressure for safer streets because a lot of people are cycling [sic]".

(Gordge, 2011).

The group hosted a mass cycling event in Stellenbosch on 12 December 2010 in an attempt to further the above objectives (see figure 4.14 and 4.15 below).

Figure 4.14 and 4.15 Images from the RideLife Event in Stellenbosch

Source: Johnny Vergeer

Along with the SRA, Mr Lemmer and the National Cycling Academy is one of the few groupings in Stellenbosch pressuring for change in the arena of sustainable transport. Mr Lemmer suggests that there is a general lack of pressure for change in Stellenbosch:

"I don't know who is going to do the work, I don't know who's going to push for it, who's going to fight it the whole time [sic]".

(Lemmer, 2011a).

Mr Lemmer points out that the SRA liaison committee represents a very narrow section of Stellenbosch i.e. relatively wealthy, white people. Indeed, the lack of involvement by poorer communities in transport decision making in Stellenbosch was clearly evident during this research process. It is dominated by professionals in the Municipality, the University and consultancies.

In addition to the efforts of the SRA and the NCA, there are several other initiatives being undertaken in Stellenbosch to improve the conditions for NMT. Remgro, a major South African company with offices in Stellenbosch, along with Distell, a large Stellenbosch alcohol manufacturer partly owned by Remgro, have set aside funds for improving the Eerste Rivier which runs through the town. This will include the creation of a bicycle/footpath running along the river which they hope will connect Die Boord (a Stellenbosch suburb) with the town and potentially follow the river to Lynedoch (a hamlet 10km outside of town) (Lemmer, 2011b; Van der Merwe, 2011a; Van Niekerk, 2011). Mr Lemmer believes this is an important and positive development which will enhance the facilities available to cyclists and, potentially, encourage cycle commuting between the largely car dependent Die Boord and Stellenbosch. Senior employees in both companies are involved with the National Cycling Academy.

Additionally, Stellenbosch has a single woonerf, being located in the elite suburbs of Mostertsdrift and Karindal (figure 4.16 below). However, according to the SRA enforcing the woonerf has been problematic (SRA, 2011b).

Figure 4.16 Road signs at the entrance to the Mostertsdrift woonerf

Source: Google

At the University, the student sustainability society, Eco-maties, has made attempts to encourage cycling amongst students (see Figure 4.17 below), but these efforts have yet to gain traction. The University's facilities management has recently begun working with Eco-maties and the Student Representative Council in an attempt to jointly promote the University's transport initiatives which are in the process of being implemented (Nel, 2011; Opperman, 2011).

This section has provided an overview of the efforts of various role-players to create better conditions for non-motorised transport in Stellenbosch. In Chapter 5 I will analyse the role of these efforts within the broader Stellenbosch transport dynamic.

Figure 4.17 Happy Thursday, organised by Eco-maties to encourage cycling on campus

Source: sun.ac.za/ecomaties

4.3 Conclusion

From the above overview, it is clear that Stellenbosch is grappling with the problems generated by a growth path highly dependent on the car. The town is clearly experiencing many of the barriers and obstacles described in Chapter 2 (see page 28). Past efforts to re-orient the town's transport system trajectory have failed and the Municipality seems unable/unwilling to induce significant change. The town continues to sprawl, levels of traffic continue to grow, the quality of alternatives remains poor and Stellenbosch is increasingly a place designed primarily, although not exclusively, for the car. As a result, the poor majority and others (students), who currently use green modes of transport, are placed at a disadvantage and sustainability, equity and quality of life are undermined.

However, there are attempts on several fronts, notably from the University, to adopt a different approach. Due to the paralysis exhibited on the part of the Municipality, it seems clear that these role-players are crucial to any process of transition. In the next chapter, I

will explore this situation in more depth through an application of the framework developed in Chapters 2 and 3.

5. Transport transition dynamics in Stellenbosch

5.1 Introduction

From the overview provided in Chapter 4, it is clear that the Stellenbosch transport system has a number of serious problems. At the same time, it has the potential to develop a radically different transport status quo, one in which equity and ecological integrity are duly respected.

In Chapter 2, I critiqued the dominant transport paradigm from the perspective of sustainable transport and transitions theory. I also explored sustainable transport solutions and the barriers and obstacles to transition. In the process, I developed a theoretical framework which I now apply to the case of Stellenbosch. I also incorporate some of the lessons deduced from the innovative case studies of Chapter 3.

Through this analysis I develop a deeper understanding of the dynamics of the transport system in Stellenbosch from the perspective of sustainable transport and transitions theory. In particular, I explore, in detail, factors which both support and hinder transition away from the current unacceptable state of affairs.

Towards the end of the chapter, I proceed to explore the contribution this thesis has made to the transitions literature.

I begin this chapter with an overview of the transport situation in Stellenbosch, as revealed in Chapter 4.

5.2 Transport in Stellenbosch: A sustainable transport analysis

The town's transport system is characterised by:

- A flat, mixed use, dense urban centre which facilitates high levels of walking and, to some extent, cycling in the town
- Growing levels of traffic as a result of car dependent growth
- Growing levels of resource intensive commuting by students and workers between Stellenbosch and other parts of the Cape Peninsula, raising the exposure of Stellenbosch to peak oil
- The associated symptoms of car invasion, i.e. the overconsumption of scarce public space by cars
- Continued low density, car dependent urban sprawl
- A lack of quality public transport
- An inconvenient walking experience despite some good pedestrian infrastructure in places
- Poor cycling infrastructure

- A high dependence on cars amongst those who can afford it, exacerbated by the problem of car-dependent sprawl which reduces the feasibility of walking and cycling

- A high dependence on poor quality public or non-motorised transport amongst low income groups

- Past efforts to alter the unsustainable transport trends in Stellenbosch have failed and the town is now experiencing the limits of car-dependent growth

- The inability of the Municipality to channel private sector development in a sustainable direction

As I established in Chapter 4, the characteristics of the town's urban centre facilitate the use of alternatives to the car (walking and cycling). It is essential that these features be enhanced and reinforced as the foundation of a more sustainable transport future for the town. The built environment of Stellenbosch is increasingly designed in a way which supports the reproduction of the middle class, and hinders that of the poor majority. While the original compact urban form of the town was supportive of sustainable transport modes (walking and cycling) and social equity, due to the ability of the poor to easily utilise these modes, growing sprawl and car-orientated design is rapidly undermining this.

Figure 5.1 The streets of Kayamandi, Stellenbosch: used by people, designed for the car

Source: Google

Increasingly, Stellenbosch relies on convenient car access for its continued reproduction. Workers, students and others move from the outer suburbs of the town or further afield each day by car, partially due to the lack of quality alternatives and the lack of affordable property in well located areas. As we saw in Chapter 4, distances are growing in Stellenbosch due to urban sprawl. This goes directly against the sustainable mobility paradigm which advocates keeping distances as short as possible and ensuring town residents have the ability to travel without requiring access to a car (Banister, 2008, 2010).

These trends generate additional traffic in the town, creating a strong demand for infrastructure which aids reliable car mobility, and necessarily undermines the quality of public space and the safety and convenience of non-motorised transport.

In addition, high levels of car dependence among the Stellenbosch elite expose the town to a number of problems, particularly with regards to energy use and peak oil. As I discussed in Chapter 2, high levels of car use correspond with high levels of personal energy consumption for transport purposes, which is out of step with ecological limits and exposes the town to the volatility of oil supply and price. As we saw in Chapter 2, sprawling, car-dependent urban forms consume more energy than dense, transit-orientated cities because they encourage/demand car use. Distant neighbourhoods, shopping centres and office parks are at greatest risk from peak oil due to their dependence on fossil fuel based transport. Businesses within central Stellenbosch which rely on regional car movement could also potentially face difficulty. Those living, working and studying in the centre of town will face less disruption from peak oil because they have the option of reducing car use either by walking or cycling to the various destinations within the compact, mixed use centre of Stellenbosch. It can, therefore, be argued that the growing reliance of Stellenbosch on regional car movement and continued urban sprawl place the town at significant risk of disruption due to potential future oil price instability.

The growing dependence of the town on energy intensive, ecologically destructive car journeys, the continued decline in the quality of urban public space and the pedestrian realm, the lack of quality alternatives to the car and the inequitable transport status quo in Stellenbosch combine to suggest that the trends being experienced in the town are deeply problematic and unsustainable. I have argued that the town has some features conducive to a more sustainable transport system but current trends (urban sprawl, rising traffic etc.) and the failure, so far, of authorities to significantly improve green modes suggest that the inherent sustainability of the central Stellenbosch urban form is rapidly being degraded. The high demand for development in centrally located areas is increasingly becoming unfeasible because it generates an amount of car traffic that cannot feasibly be carried by the town's existing road network (see the example of the Eikestad Mall in Chapter 4). In addition, the problem of over dependence among a minority of people in Stellenbosch on cars has an impact on the broader citizenry, as decision makers feel pressure to address the traffic jams of the elite rather than the real transport dilemmas of the poor who face a degraded and dangerous walking/cycling experience or poor quality public transport all within a town designed principally for the car rather than for sustainable modes of transport.

Additionally, the economy of Stellenbosch is threatened by rising levels of congestion. The ability to conveniently access destinations in the centre of Stellenbosch is declining due to an overreliance on the car for mobility. Despite objections from local businesses (see the Church street discussion in Chapter 4), there is now, as Kenworthy (2006: 77) argues "considerable information showing that central cities with strong traffic restraint are better-off economically than those with generous parking". Managed correctly, pedestrian projects can boost city economies, as well as enhancing the quality of the urban environment. This has been clearly illustrated by Copenhagen and Curitiba (see Chapter 3).

Like many other towns and cities across the globe, Stellenbosch is increasingly characterised by the 'auto-social formations' (Freund & Martin, 2007) of the global 'system of automobility' (Urry, 2004). This expresses itself most clearly in the fabric of the built environment which, in many cases, is designed for the car and not for the pedestrian. Stellenbosch Square shopping centre, the distant upmarket residential estates, the poor

pedestrian/cycling network, the car-orientated design of Bird Street and Merriman Street; are just a few examples of how the 'system of automobility' is reproduced through infrastructure and design. As a result the use of green modes is discouraged: the wealthy often have no choice but to use the car and the poor struggle to engage effectively in society given the limited mobility/access induced by a situation in which the transport modes to which they have access are of poor quality, unpleasant or dangerous (Vasconcellos, 2001). Urban sprawl and poor alternatives combine to ensure the demand for cars and oil remains strong.

From a social perspective, it is clear that the current transport dynamic in Stellenbosch reinforces the deep inequality present in South African society. An increasingly car-orientated urban environment facilitates disengagement by the middle class, who have enhanced opportunities to avoid interaction with individuals from other income groups. As was reviewed in Chapter 2, Gorz (1973), Harvey (2008), Henderson (2006) and Kunstler (1996 in Schiller *et al*, 2010) argue that a development trajectory of this sort incites a rise in individualistic behaviour and attitudes in society.

Clearly, change is necessary in Stellenbosch. There is a dire need for automobility to be contested (Henderson, 2006) and for public space to be 'reconquered' from the car (Gehl & Gemzøe, 2006). As we saw in Chapter 4, a number of municipal and university officials and town residents are keenly aware of the transport problems faced by the town, but little has been done to effectively reorient its unsustainable transport trajectory or to bolster the existing sustainable transport characteristics of the town. Plans developed to achieve transport system change (the interim transport plan for example) have, to a large extent gone unimplemented. Everywhere Stellenbosch is criss-crossed with car orientated streets, preventing the pedestrian, let alone the cyclist, from conveniently and safely moving around the town.

As we saw from the case studies in Chapter 3, there are examples from all over the world in both rich and poor countries, of cities and towns which have chosen to embark on a different path. These places have shown that:

- quality public transport and public spaces are possible in developing country cities with limited resources (Bogotá, Curitiba and Guangzhou)

- large, successful pedestrianised areas are possible and can both support economic prosperity and enhance the quality of urban life (Copenhagen and Curitiba)

- a comprehensive and successful bicycle network in a University town is possible despite a car-orientated national context (Davis)

- Growth can successfully be based on public transport rather than the car (Curitiba and New York City). Growth of this sort avoids the dysfunctions symptomatic of car-orientated development (see Chapter 2)

- reversing traffic growth and rates of car ownership is possible (Curitiba, Freiburg)

- It is possible to 'reconquer' (Gehl & Gemzøe, 2006) space from the car and create better, more sustainable streets and cities (Copenhagen, Curitiba, New York City).

As I have made clear before, all the cases discussed in Chapter 3 are very different from that of Stellenbosch but they show what can be done given the will and determination of individuals and groups, in all spheres of society, to pressure for change and to innovate. Stronger efforts are required by those seeking a more sustainable Stellenbosch to create an urban environment less orientated towards the car (Pieterse, 2008). This requires:

- The development of a transport system in which individuals can easily move around the town without a car
- shorter distances and slower speeds (Banister, 2010)
- significantly better public transport
- streets designed principally for pedestrians, cyclists or public transport rather than motorists
- and large car free public spaces to support walking, public health and social integration

Increasing the quantity and quality of street/public space that can be safely and conveniently used by pedestrians and cyclists would support a more sustainable future for Stellenbosch. As New York and other cities have shown, streets can be used for many different purposes, not just traffic. On weekends they could be exercise and recreation spaces. They could be closed on holidays. Neighbourhoods streets can be designed in such a way that sport and play by children is safe (as in Vauban, Freiberg) and the car is absent or a slow moving guest in a people orientated space.

As Peñalosa (2006) argues, developing world cities could be radically different places. A road could be a perfectly acceptable pedestrian or bicycle space but in many cases it is allocated exclusively to the car driver. Given the damage done by the cars shouldn't it be green modes which dominate the streets? Shouldn't the majority of urban streets and spaces be designated for priority pedestrian, bicycle or public transport? As we saw in Chapter 3, the redistribution of scarce urban space in favour of pedestrians and cyclists has been going on for decades in Copenhagen and Freiburg, and has recently begun in New York. However, in Stellenbosch, pedestrianising a single street (Church Street) has proved to be exceptionally difficult. Vasconcellos (2001) would argue that this attests to the power and control of the middle class, who are successfully able to reproduce the city in a way which is principally to their benefit and to the detriment of the poor majority.

The multi-level perspective, discussed in chapter 2, provides a useful way of understanding and exploring the dynamics of the Stellenbosch transport system. I will now apply it to the case of Stellenbosch.

5.3 Applied multi-level perspective

As I discussed in Chapter 2, the multi-level approach identifies three components to socio-technical transitions: the *landscape*, the *regime* and the *niche*. From the arguments presented in Chapter 2, it is clear that the dominant global urban transport paradigm demands radical transition. This necessitates a strong shift away from the car as both the dominant mode of transport and a powerful shaper of the built environment. For a

multitude of reasons, covered in Chapter 2, the role of green modes should be strengthened and enhanced. This will be essential to the broader transition to sustainable cities.

As mentioned in Chapter 2, the "system of automobility" has proven to be remarkably resilient to systematic change and this is, in large part, due to the strength and power of the socio-technical regime governing this "system of automobility". As I will explore below, the strength of this regime is reflected in the case of Stellenbosch. In Chapter 3, I explored how this dominant regime is being usurped by innovative practices in the field of sustainable transport which fundamentally contest automobile dominance and support alternative transport dynamics. The cases in Chapter 3 show that better transport systems are possible.

5.3.1 Landscape

I will now examine the *landscape* in which the Stellenbosch transport system rests. As I discussed in Chapter 2, the landscape refers to the 'conditions', 'environment' and 'pressures' facing the socio-technical regime (Hodson & Marvin, 2010a: 479). In many ways, this has already been covered in Chapters 2 and 4. The global context was covered in chapter 2 including the unsustainable impact of car dominated transport systems on both local and global socio-ecological systems. Stellenbosch is not immune from the strength of automobility and its continued global expansion. The trends in Stellenbosch are, in effect, a local expression of a global problem, one which is being experienced by a multitude of other urban settlements around the world.

On the other hand the multiple problems generated by this excessive car use create pressure for change. Low & Gleeson (2001) argue that the conventional approach to transport has been challenged by a rising recognition of its problems. In some local contexts pressure for change has occurred either due to pressure from a concerned citizenry, or from enlightened and able decision makers and officials (see Chapter 3). However, Geels & Kemp assert that generally the "pressure for change in sustainable directions is…not great and currently not oriented towards large-scale systemic change" (Geels & Kemp, 2010). In time, as oil becomes increasingly scarce and costly, as the quality of urban life begins to deteriorate even more, as human health worsens so the pressure for change will grow (Martin, 2006).

In addition, the global shift in policy and theory away from the conventional transport approach, towards one which is increasingly sustainable does have some impact on the policies chosen and implemented locally, particularly with regards to the "integrated" transport paradigm (Low & Gleeson, 2001). The transport policies of the Stellenbosch Municipality (reviewed in Chapter 4) clearly reflect this evolution. In *City Futures,* Pieterse (2008) argues that mainstream policy has never been as aligned as it is now with the theories and beliefs of progressives.

Despite all of this, it can be argued that, currently, the international landscape generates little pressure on the transport regime in Stellenbosch for change. However, in the future, the issue of peak oil and climate change, in particular, may result in a dramatic alteration in this situation.

The national context/landscape was covered at the beginning of Chapter 4. Again, there is little here generating pressure for radical change in Stellenbosch. While national policy is supportive of public and non-motorised transport this has yet to have any significant impact at a local level, particularly in the lives of the poor who continue to endure poor quality

urban transport systems despite recent action as a result of the World Cup. Stellenbosch exists within a context of national failure to successfully re-orient urban transport systems away from the dual system established during the apartheid era, with progress hampered by fragmented and unresolved institutional and funding issues (see Chapter 4). If radical change were to occur at a national/provincial government level this would obviously have implications for Stellenbosch. For example, a dramatic upgrade of the rail service between Stellenbosch and other parts of the Peninsula could both reduce traffic entering the town and enhance the lives of the poor who commute to Stellenbosch each day. Furthermore, the existence of a high quality public transport system could ensure that ecologically destructive car mobility is no longer necessary for the successful reproduction of the middle class. But this is something which can only be achieved by decisions at a national level. The lack of quality public transport connections between Stellenbosch and others parts of the Cape Peninsula, effectively limits what can be done locally. Despite these limits, there is still significant scope for enhancing the sustainability of the Stellenbosch transport system, especially through improvements in non-motorised transport and supportive car restrictive measures such as slower speed limits, redesigned roads/public spaces and widespread traffic calming.

At a local level the primary feature of the landscape generating pressure for change is traffic congestion. As I discussed in Chapter 4, it became clear during the research process that decision makers view traffic congestion and parking issues as the principle problem facing the Stellenbosch transport system. The University, in particular, is responding to the pressure generated by rising levels of traffic induced by its growth, as well as associated parking problems.

Apart from the efforts of Carinus Lemmer, the National Cycling Academy and the Stellenbosch Ratepayers Association there is little pressure coming from the community for change. Overall, there is a lack of significant top down or bottom up pressure in Stellenbosch for radical change in a sustainable direction. Rather, pressure for change is coming from growing levels of congestion and parking problems that are inevitable in a town without effective alternatives to the car.

So, we now have an overview of the landscape in which the socio-technical regime is located. I will now examine this regime in greater detail.

5.3.2 Regime

A regime can be described as the dominant “culture, structure and practices” (Nykvist & Whitmarsh, 2008: 1374) governing a socio-technical system. A socio-technical regime includes daily practices and habits, institutions, beliefs and infrastructure which collectively perpetuate a particular regime. From the arguments in previous chapters, it is clear that globally the automobility regime is powerful and resilient. As I will argue below, the trends currently being experienced in Stellenbosch illustrate a local example of this power, as the various elements of the regime (beliefs, institutions, infrastructure etc.) cooperate to perpetuate an unsustainable transport system.

The Stellenbosch Municipality seems incapable or unwilling to deal with the current situation, and traffic continues to grow. As I established in Chapter 4, public and non-motorised transport issues are not a priority for decision makers in the Stellenbosch Municipality. Progress is slow and incremental. One of the principle components of the automobility regime in Stellenbosch is its transport department. This organisation is

focussed, principally, on road maintenance, rectifying traffic congestion and infrastructure delivery. It does not possess the more complex operational capacity required to provide a quality public transport service or other innovative sustainable transport initiatives.

The views and opinions of those working for the department, as explored in Chapter 4, largely support the current state of affairs. In particular the work of the traffic engineering division perpetuates rather than transforms the current unsustainable system (see Chapter 4). Members of the Stellenbosch Municipality are still very much geared towards ensuring effective car mobility and maintaining the current disproportionate allocation of public space to the car. In some instances this directly undermines the creation of better conditions for NMT (for examples see Chapter 4).

The perceived need to cater so amply for the car is reflected in the belief by the Municipality's Transport Manager that continuing to ensure convenient car access is important for attracting a high value people and businesses to Stellenbosch. The belief in the inevitability of widespread car ownership and on the need to cater for this is illustrated by the following quote, again, from the Municipality's Transport Manager:

"And I also firmly believe you cannot take the vehicle (the car) off the road…So you're not going to reduce car ownership and it will grow because as people earn more, they want cars [sic]".

(Van der Merwe, 2011a).

Such views help to perpetuate the existing unsustainable system.

As a department geared primarily towards road and traffic issues and without the capacity, resources, will or political support to pursue more radical change, it is unlikely to be a major driving force in the process of transition. In the future this could change, if its capacity is enhanced and the organisational structure is adjusted to support the development of green modes.

During the course of my research it became clear that the dominant paradigm amongst senior decision makers, both in the University and the Municipality, is one of integrated transport where all modes are, in theory, treated equally. There was little enthusiasm for strong restrictions on car mobility and use. Green modes are supported primarily for their potential to reduce car use, rather than enhancing the well-being of those without cars. However, Kenworthy (2007) argues that after such a prolonged period of car-first planning, it is essential for decision makers to direct the majority of resources towards green modes in a biased way to aid in correcting this imbalance. In addition, Vasconcellos (2001) argues the demands of all transport users cannot be equally met within a context of limited urban space and competing uses. In many cases it is impossible to both support car mobility and NMT safety. If a sustainable transport system is to be achieved, difficult choices have to be made. Choices made to support an enhanced pedestrian realm will often make car use increasingly inconvenient. The examples in Chapter 4 of Merriman Street, Bird Street, Church Street and the proposed parking outside the Theology Building all illustrate how pedestrians, cyclists and motorists compete for scarce urban space and how, currently, the motorist is favoured in this competition through car-orientated urban design. So not only is there a lack of resources, capacity and political will within the town, there is also the resilient continuation of a car-orientated paradigm which has important implications for decision making and resource allocation.

Other elements within the Municipality, such as members of the planning department or the newly appointed Head of Transport and Transport planning are more supportive of a transition away from car dominance. However, as I explored in Chapter 4, past attempts by the Municipality to fundamentally reshape the Stellenbosch transport system have failed. The pedestrianisation of Church Street, had it occurred, would have been an innovation for Stellenbosch. If multiple innovations occur, if multiple points of contestation emerge (Chatterton, 2010; Pieterse, 2008), which collectively challenge the dominant paradigm, then the potential exists for real transition to occur.

As I explored in Chapter 4, the infrastructure of Stellenbosch also supports the perpetuation of the automobility regime. Car-orientated road design, long distances and sprawling development, a non-existent bicycle network, the lack of quality public transport and an inconvenient, inconsistent and limited pedestrian network are just some of the factors which encourage car use. The Stellenbosch authorities have been unable to limit urban expansion and growing car use. As distances grow minibus taxis are required to travel ever further distances to deliver their passengers to the sprawling destinations of a town spatially orientated towards the middle class. Rising fuel costs will burden many: car drivers, taxi users and taxis owners. Economically, it is imperative that distances are kept short in order to protect the economy in the face of rising oil prices.

Another element of the regime is the high dependence of the Stellenbosch middle class on the car. The most powerful and wealthy elements of society have developed a way of life that revolves around car travel, which is resistant to change and reinforces the unsustainable transport regime in Stellenbosch. The acceptance of the car as a normal part of everyday life and the strength of middle class car culture, both nationally and in Stellenbosch, suggests that little pressure is likely to emerge from this important and influential group for change in a sustainable direction. Rather, as Vasconcellos (2001) argues, pressure from this class is directed towards enhancing infrastructure for the car.

Also, in some cases private sector development in Stellenbosch reinforces the current unsustainable regime. This includes developments such as De Zalze, Longlands Estates and the Eikestad Mall. These developments have, or are likely to, further degrade the transport situation in Stellenbosch. All are going ahead despite opposition from the Municipality, indicating the strength of private sector interests in shaping the Stellenbosch urban form. The also is illustrative of the limited capacity of local government structures to direct development in a sustainable direction.

So, through infrastructure, institutions, habits and beliefs the unsustainable transport system of Stellenbosch is perpetuated. Any change emerging from within the regime is likely to be incremental and slow, which is inadequate given the pressing need to radically transform the current unsustainable system.

I have attempted to provide an overview of the socio-technical transport regime in Stellenbosch. The strength and power of the regime supports and reinforces this local expression of the global “system of automobility” in Stellenbosch. However, as I shall explore in the next section of this chapter, there are elements within the Stellenbosch transport dynamic which diverge from the dominant, car-oriented transport paradigm. These elements may be central to any potential transition.

5.3.3 Niche

Within Stellenbosch there are a number of niche innovations occurring. It is impossible to know whether or not these assorted innovations will generate sufficient traction to induce a transition to a more sustainable system. In chapter 2, I identified a niche as a protected space of innovation where "norms and practices are developed which depart from those of an incumbent technological regime" (Berkhout *et al*, 2004: 48). As I have established above, the "incumbent technological regime" is that of automobility.

Through this research process I have identified a number of niche innovations within Stellenbosch which include:

- The proposed University plans
- The current use of green modes by the urban poor, students and others
- The attempts by officials in the Municipality to create a more pedestrian orientated historic core, including Church Street
- The grassroots efforts of the National Cycling Academy
- The NMT Liaison Committee
- Private initiatives to improve the river path

All of these innovations represent attempts to deviate in some way from the norm of car-orientated development.

As I discussed in Chapter 4, the University's transport plan includes aspects which depart significantly from the "norms and practices" of the conventional transport approach. The substantial role of the University in the town and its capacity to implement projects suggests that the institution's transport initiatives, if implemented successfully, hold the greatest transformative potential. The University's woonerf and associated cycling initiatives would dramatically enhance both the space for and safety of NMT transport. Similarly, a University public transport system has great potential to support a sustainable transport future for Stellenbosch, especially if later extended to serve the broader Stellenbosch community, as planned. The University's recognition that the solution to its transport problems lies chiefly with green modes is a significant departure from a car-orientated approach, as is its long term vision of a green campus, largely free of cars.

Similarly, there are officials within the Municipality, most notably the Head of Spatial Planning, Heritage and Environment, which would like to see a significant enhancement in the quality of the pedestrian realm, particularly in the historic core of Stellenbosch. This innovative approach is reflected in the Municipality's draft SDF which is guided by principles which deviate radically from the conventional paradigm. Such projects, if implemented, could encourage the use of NMT and enhance the quality and quantity of public space in Stellenbosch. Unfortunately, such projects have not been successfully implemented in the past (see the discussion in Chapter 4 on Church Street) but there are positive signs that some progress could be made in the near future due to the current consensus amongst senior Municipal officials on the matter (again see Chapter 4).

In addition, the grassroots action of the National Cycling Academy, the RideLife Coalition and the pressure of the Stellenbosch Ratepayers Association are important niche innovations. They share a common acceptance that the status quo is untenable and that change is necessary. Carinus Lemmer, through his networking and lobbying of decision makers and other interested parties in the University, Municipality and broader community, has and continues to play an important role. The attempts by him, eco-maties and others to develop innovative projects to enhance the role of cycling in Stellenbosch are important, as is the constant pressure from the SRA on the Municipality and developers to enhance the conditions for NMT in the town.

It can also be argued that the daily travel habits of the Stellenbosch urban poor are a form of innovation, as are the habits of others in Stellenbosch who already walk and cycle to move around the town. The poor often have no choice but to walk, cycle or use poor quality public transport. This daily use of green modes departs from the paradigm of car dominance. The potential of these exiting habits to form the basis of a sustainable transport system suggests that the priority in decision making should be supporting and enhancing green modes already used by the poor, students and others. The transport habits of the poor have not been entirely ignored by decision makers. For example, the Municipality has invested in improving taxi rank facilities (Engineering Services, 2011).

However, it is significant that there is no large scale, organised movement pressing for a sustainable transport system in Stellenbosch, especially from poorer sections of the Stellenbosch community. This provides a potential explanation for the focus by Stellenbosch decision makers on middle class transport issues, including congestion, parking issues and providing alternatives to the car.

In addition, student initiatives to advance sustainable transport, such as those of Eco-maties, have yet to achieve mass participation and support. Pressure from such groups is key to ensuring the sustainable transport initiatives of the University are successfully implemented.

The above overview of niches within the Stellenbosch transport system suggests that there are innovations developing in Stellenbosch which depart from the conventional approach. As I discussed in Chapter 2, change in a sustainable and egalitarian direction requires action and pressure at multiple points. These multiple sources of contestation have the potential to induce radical change, in particular circumstances (Pieterse, 2008). The greater the number and scale of the innovations the greater the chance that they will successfully grow and expand, eventually usurping the dominant paradigm. Each innovative endeavour has the potential to generate “new possibilities for radically different cities” (Chatterton, 2010: 236).

As I discussed in Chapter 2, Hodson & Marvin (2010) argue that the effective co-ordination of resources and actors in the purposive pursuit of transition is one strategy which, they believe, can enhance the potential for transition. This requires a degree of capacity to co-ordinate the resources of actors, who often have divergent approaches to the problem at hand. It is clear that there are different role-players attempting to create a more sustainable system. The co-ordination of these efforts has the potential to significantly boost the possibility of transition (Hodson & Marvin, 2010). In Chapter 3, several of the case studies achieved success as a result of progressive political leadership, enhanced capacity to address complex transport problems and an active citizenry pressing for change in a sustainable direction. While certain segments of the population are active in resisting car dominance (the SRA for example), it is clear that Stellenbosch, or more specifically the Municipal

government, lacks the capacity or the political will to pursue a more sustainable transport system.

Within Stellenbosch there are both elements which support a continuation of the current unsustainable system and elements which depart from that system and seek to create something new. The eventual outcome of this complex interaction between these multiple processes is impossible to determine with any accuracy. However, in order to improve the likelihood of a sustainable transport future for Stellenbosch it is critical that innovative measures be supported and that work is done to identify and contest the elements of the regime which help to perpetuate the existing system. As Urry (2004) argues:

"*…the current car-system could not be disrupted by linear changes but only by a set of interdependent changes occurring in a certain order that might move, or tip, the system into a new path".*

The current state of affairs holds the seeds of multiple futures, both sustainable and unsustainable. The realisation of a transport system which is in line with the ideal of a "socially just and ecologically sustainable world" will require interested individuals/groups to exert pressure at strategic sites of political contestation (Pieterse, 2008), which, in effect, is innovation. This is already happening, to some extent through the actions of the SRA, National Cycling Academy and certain officials within the Municipality and the University. Ultimately, success will rely on the ability of those in favour of a sustainable future to co-ordinate resources in support of their cause, as Chatterton (2010: 236) argues each future needs "different political wills, commitments, resources, forms of organising and institution". Currently, the town's resources are geared primarily towards maintaining car dominance but this is changing. This is why the plans of the University are so important because they represent a significant increase in resources and political will devoted to the pursuit of a more sustainable transport system. With growing pressure on energy supplies and rising global climate issues the pressure to support radical change, both nationally and in Stellenbosch, will grow.

The ability of a regime to resist change is determined by its "dynamic stability" as Lawhon and Murphy describe below:

"When these actors, and any associated institutions, practices, and landscape factors, are aligned through shared understandings of priorities, appropriate actions, and the rules and conventions governing the regime, the system is 'dynamically stable' (meaning only incremental innovations occur) and locked-in to a particular socio-technical trajectory"
(Lawhon and Murphy, 2011: 8).

As I explored in Chapter 4, it is clear that the dominant role-players in the regime broadly support a state of affairs in which the car continues plays a significant role in the town's transport system. While there is recognition of a problem amongst decision makers, this is largely focussed on traffic and parking issues as well as the lack of alternatives to the car. And while there are efforts to create a more balanced, integrated transport system there is no recognition of the need to radically reshape the system to create a more equitable and sustainable transport network. This is arguably the result of the dominance of the elite in decision making and the virtual absence of the poor or their representatives. As such, there is little pressure to focus on the constrained mobility which daily blights the lives of the poor. Baeton (2000) support this argument:

"Transport exclusion implies that the already disempowered segments of society are further disadvantaged by the lack of control they can exert over transport supply (irrespective of transport modes), so that they are deprived of basic levels of transport opportunities. The mobile wealthy, in contrast, see their control over moving across space—and therefore, by implication, their control over socioeconomic conditions in society—confirmed and reinforced by the current mobility system".

(Baeton, 2000: 83)

This is in line with the argument by Lawhon and Murphy (2011: 21) who suggest that "defining a problem in a particular way can lead to a particular solution". Therefore, defining the transport problems in Stellenbosch as congestion has led to solutions focused on providing alternatives to the car. This has the potential to direct decision making and resources towards projects and policies aimed at furthering this cause, rather than that of enhancing the green modes already used by the poor.

I would argue that the "dynamic stability" of the current regime is increasingly being threatened by a number of factors including the socio-technical conflict between Municipal officials, the increasingly dysfunction of the current transport system as evidenced by congestion and capacity exhaustion, and the various innovations occurring in Stellenbosch, notably those of the University. However, the innovations that are occurring are still in their infancy and relatively weak. Success ultimately depends on strengthening these innovations.

I will now proceed to explore the contribution this thesis has made to the transitions and sustainable transport literature.

5.4 Contribution to knowledge

In this section I explore the contribution this thesis has made to knowledge, and in particular, to the transitions literature.

Studies in sustainable transport, such as those of Banister (2007), Kenworthy and Newman (1999), Schiller (2010) and others often focus on the policy/capacity constraints to achieving more sustainable transport systems but fail to incorporate a broader analysis of the deeper power dynamics at work. These dynamics perpetuate systems which support a particular kind of inequitable capitalist reproduction and middle class dominance. Through my incorporation of literature that grapples directly with such issues (Martin, 2009; Paterson, 2007; Urry, 2004; Vasconcellos, 2001) I have sought to expand my analysis. While I do explore policy, capacity and resource constraints, I have illustrated how these facets of an unsustainable regime interact with deeper dynamics, to collectively prevent transition.

In addition, I believe this thesis has addressed some of the key failings in the transitions literature. The article by Lawhon and Murphy (2011) provides a critique of mainstream transitions theory and the potential contribution that can be made by insights from political ecology. These criticisms include:

- An insufficient examination of the role of power
- A disproportionate focus on technological artefacts
- An overwhelming focus on cases from the developed world, particularly Europe and

- A geographic “naiveté”, with the focus of transitions analysis on the nation-state.

I begin by examining the first two points concurrently. Lawhon and Murphy (2011) suggest that there is a need for transitions theory to “better able to account for the role that power plays in guiding or preventing transitions toward more sustainable outcomes” (Lawhon and Murphy, 2011: 3). I believe my analysis is grounded in issues of politics and power, and specifically the role of power in reinforcing unsustainable regimes and preventing radical change. My many references to the power of the global “system of automobility”, the middle class, the dominant car-orientated paradigm and the automobile-industrial complex collectively suggest that I have, indeed, incorporated the role of power. I have repeatedly highlighted the contested nature of urban socio-technical transitions and how different paradigms compete for dominance. I have also pointed out the conflict over scarce urban space that occurs between middle class car drivers and poor pedestrians. I have attempted to incorporate these issues into a transition analysis, in the process foregrounding the role of power, inequality and politics.

In addition, the Lawhon and Murphy (2011) criticise transition literature for being overly concerned with technological artefacts such as solar power or electric cars, and how these ‘sustainable’ technologies can become dominant. However, I have sought to avoid such a focus. While I have advocated the use of green transport modes and criticised the car itself, my focus has been on the deeper dynamics which perpetuate a socially inequitable and ecologically destructive system, rather than the technologies themselves. This includes the associated practices, infrastructures, power dynamics, dominant beliefs and daily ways of life which support particular technologies, such as the car. While the role of technology is important, the power dynamics and the unsustainable development paths that technologies support are also crucial. The car is not just a car, it is a technology which aids in the reproduction of the capitalist system and ensures the middle class primarily exist in a way which, on the one hand, supports capital and on the other dominates all other modes of transport and by extension other social classes. I established, in Chapter 2, that the car is not necessary for urban mobility. Other modes of transport could adequately take its place. Who benefits from the dominance of a particular technology? That is the question that must be asked, according to Lawhon and Murphy (2011), and I believe I have made some progress towards developing an answer to this question in this thesis.

The “system of automobility” endures because it is supported by the most powerful elements of society. This research project has explicitly identified these links, challenging the neutrality often bestowed on particular technologies and highlighting the deeply political nature of the process of transition for sustainable development. So as Meadowcroft (2009) in Lawhon and Murphy (2011: 11) argues “sociotechnical transition research must do more to analyse the ways artefacts are embedded into society and the consequent social impacts”. Through an exploration of the socio-technical regime supporting the present unsustainable system in Stellenbosch and an examination of the “social impacts” of this system, I believe this research project has made some progress in this regard.

In addition, this research project has sought to depart from the literature, as described by Kenworthy (2007), which promotes alternative car technologies as the solution to the problem of unsustainable transport. I have shown how the car has a far broader impact on socio-ecological systems, which the transfer to hydrogen technology, for example, would not resolve.

Another criticism of transition theory, as argued by Lawhon and Murphy (2011), is its focus on the nation-state as the primary unit of analysis:

"In short, socio-technical transition theory fails to properly "ground" the institutions governing regimes and niches within specific territorial contexts in order to more adequately explain why progress toward sustainability proceeds in a spatially uneven manner".

(Lawhon and Murphy, 2011: 15).

I would argue that my application of the MLP to the case of Stellenbosch effectively transcends this criticism by exploring the features of this specific territorial space which influence the "progress towards sustainability".

A further criticism of transition theory is its focus on the developed world and particularly Europe, especially with regards to case studies (Lawhon and Murphy, 2011). Clearly, this thesis has provided a case study from a quite different context; one in which social inequality is far greater, poverty levels higher and institutional capacity lower. I have illustrated the relevance of the MLP perspective to the case of Stellenbosch, despite its genesis in very different European context. This has been achieved by highlighting the link between the dominant regime and its role in perpetuating inequality and poverty. The integration and application of both radical transport and transitions theory has aided this analysis. By exploring the case of Stellenbosch, I have answered Lawhon and Murphy's call for an extension in the focus of case studies:

"If socio-technical transition theory is to have greater relevance to a wider audience, it is critical for its promoters to diversify the range of case studies analysed. In particular, there needs to be a more intensive engagement with the global South in order to improve the theory's broader applicability and rigor."

(Lawhon and Murphy, 2011: 16).

Lawhon and Murphy (2011: 2-3) argue that, conceptually, sustainable development "ends" are often well developed, such as sustainable transport ideals or economies powered by renewable energy. On the other hand the "means" (i.e. how is a state of sustainable development to be achieved?) have received relatively little attention. Increasingly, it is becoming clear that a greater understanding of these "means" is vitally important. The enduring state of unsustainable ways of life, despite a heightened awareness, of their faults and attempts by states, non-government organisations, pressure groups and others to chart a more sustainable course, suggests that past efforts have failed, partly due to a misunderstanding of the entrenched power that perpetuates unsustainability. To rectify this problem, transitions theory seeks to explore the dynamics of change and how it can be achieved. To an extent, this thesis has examined the "means" of achieving transition, through an exploration of the difficultly involved in such a process given the powerful barriers to change, as well as the opportunities for change created by landscape pressures and niche developments. As Lawhon and Murphy argue, the MLP approach aids those with an interest in:

"…understanding how and why certain unsustainable development paths have evolved and what constrains a society, region, industry, or community from shifting toward more sustainable technical practices and social, economic, and political institutions".

(Lawhon and Murphy, 2011: 3).

Lawhon and Murphy (2011) argue that is it critical to deepen our understanding of the dynamics at play in the process of sustainable development transition. This thesis has contributed to the growing literature on transitions by applying transitions theory to the case of Stellenbosch. In so doing, I have developed an understanding of the dynamics at work. The authors argue that transition partially depends on the ability of those interested in change "to transform socio-technical rules in ways that can redirect a regime, and the systems it is part of toward a more socially and environmentally sustainable direction" (Lawhon and Murphy, 2011: 8 -9). So, this research project has attempted to identify elements of the regime which require "redirection". Notably, the way in which roads, neighbourhoods and entire towns are designed to principally facilitate car mobility.

From the above arguments, I believe it is clear that I have contributed to the transitions literature by successfully responding to and incorporating critiques of the mainstream approach. I have explicating explored the role of power dynamics, moved beyond a technology focus and provided an urban case study from a non-European, developing world context. In addition, I have moved beyond a simple examination of the policy and resource constraints to transition, to explore deeper systematic barriers to change by integrating radical transport, sustainable transport and transitions theory.

5.5 Conclusion

The above chapter sought to provide an analysis of the trends and dynamics of the Stellenbosch transport system from the perspective of both sustainable transport and transitions theory. It is clear that the situation in Stellenbosch is complex. There are powerful trends, ways of life, attitudes and infrastructures which support the perpetuation of the current inequitable and ecologically destructive transport system. However, as I discussed in this chapter, there are activities within the town which depart significantly from the conventional paradigm of car dominance. Successful transition to a more sustainable transport system will require a reinforcement and support of these activities as well as the identification and deconstruction of the elements of the socio-technical regime which perpetuate the unsustainable system currently in place.

A failure to achieve transition will result in a situation in which the town is increasingly exposed to the risks of rising energy prices and growing social inequality. If urban expansion is not curtailed and if green modes are not radically enhanced then the current unsustainable trends in Stellenbosch look set to continue, threatening both the local and global socio-ecological system.

I also provided an overview of the contribution this thesis has made to the literature, specifically through a response to and incorporation of critiques of mainstream transition theory. The next and final chapter will provide an overview of the thesis, the principle arguments and conclusions, limitations and well as areas for further research.

6. Conclusion

This sixth and final chapter of my thesis will provide a summary of the main findings and conclusions of this research project.

In Chapter 1 I set out my research objectives, which are reproduced below:

1. To gain a thorough understanding of the dynamics of the Stellenbosch transport system from the perspective of sustainable transport and transition theory with a particular focus on walking, cycling and public space

2. To gain a thorough understanding of the policy approaches of both the Municipality and the University with regards to transport and

3. To gain a thorough understanding of the barriers to a more sustainable transport system in Stellenbosch

4. To gain an insight into the innovations occurring in the Stellenbosch transport system

Considering the content of Chapter 2, 3, 4 and 5, I would argue that I have successfully achieved these objectives. I have developed a thorough understanding the dynamics of the Stellenbosch transport system, the policy approaches of those involved, the barriers to change, and current transport innovations in the town.

In Chapter 2 I established the theoretical basis for this research project. I explored the concept of sustainable development and the role of cities and infrastructure in the process of ecological destruction and social inequity. I determined that cities need to be reshaped so they support ways of life which are socially and ecologically sustainable. I then introduced the concept of the "system of automobility", the powerful set of interlinking components which supports the persistence of global car dominance. I then explored the multiple arguments against automobility and highlighted it's ecological, social and economic impact. From these arguments it was made clear that such transport systems are not sustainable. In particular, the negative effect of automobile dominance on social inequality in developing countries is a cause for concern. I then proceeded to explore the solutions that have been proposed by various thinkers to these problems which principally focus on radically reshaping the city so that it supports and encourages movement by green modes of transport rather than the car. By this stage in Chapter 2, I had established the deeply problematic nature of the dominant urban transport model and the possible solutions to the problem. However, it was also clear that despite these problems the "system of automobility" has proved resilient. So my discussion then moved onto the barriers to transition, ranging from policy constraints, socio-technical divisions and the power of the automobile industrial complex. In order to further this argument and my understanding of the process of change/transition, I briefly explored transition theory, the multi-level perspective as well as the work of Pieterse and Chatterton. Combining these arguments and applying them the content explored earlier in the chapter, it became clear that the strength and resilience of socio-technical automobility regime or the "system of automobility" is great and the level of innovation, contestation and pressure has not reached the necessary point to induce a global transition to a more sustainable urban transport regime. Transition is an unpredictable process but growing landscape pressures such as peak oil combined with strengthening alternatives developed in niches, together hold the key to successful

transition. This then, is a summary of the theoretical framework developed in Chapter 2. It was then applied to the case of Stellenbosch in Chapter 5, in order to develop an understanding of the situation there from the perspective of transition and sustainable transport theory.

While Chapter 2 established the power of car dominated systems, Chapter 3 sought to explore examples of sustainable transport innovation occurring around the world which depart from the dominant regime. I deemed this necessary in order to establish what is possible despite the constraints explored in Chapter 2. The cases showed how cities and towns were implementing innovative projects and policies which supported green modes and created a more humane, balanced urban environment. This was driven by progressive leadership, capable local government and an active citizenry. As a result of these projects and policies, the cities and towns explored in Chapter 3 support, to a greater or lesser degree, low energy, socially equitable mobility choices. In addition, the existence of real alternatives to the car suggests that their resilience is relatively high in the face of an uncertain energy future. The cases in Chapter 3 also helped to dispel the myth that car dominated transport systems are an inevitable part of successful economic development.

Armed with the evidence from the cases of Chapter 3 and the theoretical framework developed in Chapter 2, I sought to explore the case of Stellenbosch in Chapter 4 and so achieve research objectives 2, 3 and 4 by gaining a deep understanding of the dynamics of the Stellenbosch transport system. I began by providing an overview of the national urban transport context and how it remains deeply inequitable and unsustainable despite years of policies which support an enhanced role for public and non-motorised transport. I then moved onto the case of Stellenbosch itself. Among other things, I explored:

- The transport status quo
- Unsustainable transport trends in Stellenbosch including rising levels of traffic and urban sprawl
- The policies and approaches of the Municipality and the University
- The barriers and obstacles to developing a more sustainable transport system
- The attempts by various individuals and groups to pursue innovative projects

In Chapter 4, it became clear that Stellenbosch is experiencing a number of transport problems including a deeply inequitable transport dynamic and a car dependent development model which is rapidly approaching its limits. Stellenbosch is also increasingly characterised by an urban environment designed, principally, for car mobility. The town displays an absence in quality public and non-motorised transport facilities, with public space dominated by the car. This is despite the inherent potential of the town, especially with regards to non-motorised transport. Meanwhile, the Municipality has neither the will, capacity nor resources to address the issues at hand. Past attempts to deviate significantly from the car dominance have, largely, failed despite the presence of individuals within the Municipality who support a more balanced transport system. At the same time the University, the Stellenbosch Ratepayers Association and the National Cycling Academy, amongst others, are pressing for a more sustainable approach to transport in the town.

Having constructed the case of Stellenbosch in Chapter 4, I set out to apply the theory developed in Chapter 2 and the lessons of Chapter 3 to this case in order to achieve research objective 1. This formed the content of Chapter 5.

Through an application of the theory it became clear that the transport situation in Stellenbosch is not sustainable for a number of reasons including:

- The town is principally designed for the car, supporting the over consuming, energy intensive lifestyles of the elite and limiting the lives of the poor majority

- The high level of car dependence among the Stellenbosch elite undermines the resilience of the town, exposing it to the serious risk of instability given an uncertain energy future

- Continued sprawl and the concurrent entrenchment of car dependent lifestyles serve to enhance this risk

- The efficacy of walking and cycling as viable alternatives to the car is undermined by current developments

- The town will become increasingly dysfunctional due to the traffic problems generated by excessive dependence on the car

- The conventional approach to transport endures amongst certain Municipal officials and decision makers

So like other towns and cities across the world Stellenbosch has been "adapted to the convenient circulation of automobiles at the expense of other interests, especially pedestrians and public transport users" (Vasconcellos, 2001: 71 – 72). As a result, it is increasingly a place best suited to the reproduction of the car-driving, middle class minority.

However, like any complex system the picture is mixed, as Vasconcellos argues:

"…the organisation of these aggressive built environments did not prevent the weakest roles from finding their space. No role is totally rejected, or limited on a city-wide scale, but the weakest have to submit themselves to the needs of the strongest".

(Vasconcellos, 2001: 71 – 72).

So, Stellenbosch does have some characteristics which are supportive of a sustainable transport future. This includes a mixed use, walkable urban centre, relatively high levels of walking and cycling activity, high levels of public transport use amongst low income communities, and some pedestrian friendly infrastructure in the town and on the University campus. But, as I argued in Chapter 4 and 5, these positive features are being eroded by current development trajectories.

In Chapter 5 I also put forward solutions to the problems being experienced by Stellenbosch which largely revolve around enhancing green modes of transport, restricting car use and reshaping the built environment to support walking, cycling and public transport.

Given this context, I argued that the case of Stellenbosch reflects a local expression of the global "system of automobility". I then proceeded to apply the multi-level perspective of

transition theory to the case of Stellenbosch in order to enhance my understanding of the transport dynamics in the town.

From this analysis it became evident that the pressure emerging from the global and national landscape was minimal. Locally, parking and congestion problems were generating pressure for action. At the same time, a strong socio-technical regime exists in Stellenbosch, supporting the perpetuation of automobility in the town. This complex, multifaceted regime is composed of infrastructure, urban form, daily ways of life, institutions and beliefs which collectively reinforce the existing unsustainable system, as Geels and Schot (2007: 400) argue:

"Sociotechnical regimes stabilise existing trajectories in many ways: cognitive routines that blind engineers to developments outside their focus, regulations and standards, adaptation of lifestyles to technical systems, sunk investments in machines, infrastructures and competencies".

Elements of the Stellenbosch regime include:

- Car-oriented town infrastructure and road design
- Urban sprawl
- Poor or non-existent quality alternatives to the car
- Car dependence amongst the most powerful elements of society
- Beliefs and actions on the part of decision makers which support this regime or limit radical innovation
- A Municipal transport department geared towards road maintenance and traffic engineering.

After my exploration of the regime, I moved onto an examination of niche innovations occurring in Stellenbosch, which depart from the dominant paradigm of automobility. This includes the University's transport plans, the innovative approach of the Municipality's Head of Spatial Planning, the work and pressure of the Stellenbosch Ratepayers Associations, the NMT Liaison Committee and the National Cycling Academy. These innovations, if successful, hold the potential for a radically different future for the town. Over time, as international and national pressure for change grows, so the opportunities for strong innovations to breakthrough and induce transition will grow. Supporting innovative approaches is a key strategy in achieving transition.

As I argued in Chapter 2, transitions can occur in a variety of ways. The multi-level perspective "understands transitions as outcomes of alignments between developments at multiple levels" (Geels and Schot, 2007: 399). In other words, transition can be supported by developments at all levels: niche, regime and landscape. The right combination of developments, at the right time, given the right circumstances can induce regime change. While the landscape is largely beyond the control of those interested in change, both the regime and the niche can be influenced to enhance the likelihood of change. Elements of the regime which support the existing unsustainable state of affairs can be identified and contested, deconstructed/modified so that they aid rather than hinder transition, while

niches can be supported thus enhancing their capacity to challenge the dominant regime (Berkhout *et al*, 2004; Geels and Schot, 2007). Through the analysis in Chapter 5, I identified aspects of the regime that are supporting the perpetuation of automobility in Stellenbosch as well as niche innovations which seek to develop alternative approaches which depart from automobility.

In the final section of Chapter 5, I explored the contribution this thesis has made to both sustainable transport and, in particular, transitions literature.

At this stage of my thesis, I believe it is possible to argue that I have successfully fulfilled my research objectives.

6.1 Limitations and future areas of research

As I explored in Chapter 1, there were a number of limitations and constraints confronted during this research project. There are many ways in which my findings and conclusions could have been strengthened. Below I list a selection of these:

- Figures for energy use and CO_2 emissions in the Stellenbosch transport sector are currently unavailable. Such figures could have provided deeper insight into the town's contribution to energy consumption and global warming. It would also have been useful to have data on transport energy use and CO_2 emissions among different income groups in Stellenbosch as well as the contribution that different income groups make to total transport energy consumption and CO_2 emissions in Stellenbosch. Such data will be necessary going forward in order to measure the success or failure of efforts to create a more sustainable system.

- Details on the transport dynamics of sprawling developments such as De Zalze, in particular detailed descriptions of how those who work on the estate in low paid positions travel to work and from where i.e. how has sprawl affected their lives?

- The nature of "car culture" amongst students in Stellenbosch and amongst the Stellenbosch elite and the contribution it makes to the perpetuation of the current regime.

- Detailed insights and opinions from those who walk, cycle and use public transport in Stellenbosch on the obstacles they face in their movement. Such insight could have added a greater level of depth to my analysis.

- I could have devoted greater attention to the role of business, especially the resource-rich multinationals with headquarters in Stellenbosch, and the potential contribution they could make to the process of transition.

- The role of taxi industry in Stellenbosch did not receive significant attention in this thesis but, clearly, will be a crucial component of any sustainable transport transition.

- I could have explored in more depth the role of engineering education and standards, especially the prescriptions of road design, to deduce the role they play in regime reinforcement. I could also have explored how car-centric engineering

standards created in developed countries are applied to very different, developing country contexts and how this contributes to a deeply inequitable state of affairs.

The regime supporting car dominance is incredibly complex and multi-faceted. To explore every element in detail is impossible given time and resource constraints. Besides the features I have explored in this thesis, the dominant regime is also supported by a culture where car use is accepted as 'normal' and reinforced through the media and popular culture. The simple depiction of a family driving a car on an American sitcom, is an element of the automobility regime. As are the daily peak hour traffic reports on radio stations, popular car shows such as Topgear and the news reports of horrific road accidents which fail to fundamentally critique a system which facilitates such atrocities (Paterson, 2007). These cultural aspects of automobility are a central pillar aiding its endurance, but I have not explored the role they play in Stellenbosch dynamic primarily due to time constraints and a personal belief that their role can be taken as given and largely beyond the control of those interested in change at a local level.

What this section seeks to illustrate, is how it is difficult, perhaps impossible, to construct a complete picture of all the components of a socio-technical system due to its complexity. However, this thesis has, I believe, succeeded in identifying those aspects which are most salient to the process of transition. Despite the limits and barriers described above, I would argue that they have not been of such a magnitude as to prevent the successful completion of this thesis.

All the areas mentioned above could be avenues for further research. In addition, the combination of radical transport and transition theory that I have employed in this thesis could be used to explore the transport dynamics in other South African urban contexts. Such research would deepen our understanding of the barriers to change in these specific urban areas, as well as the innovations emerging which contest the dominant approach to transport. The relatively low rate of car ownership in South African cities suggests that sustainable transport solutions could be far more car restrictive that those emerging from developed world contexts such as Australian (Newman & Kenworthy) or the United Kingdom (Banister). The work of Peñalosa (2006) is illustrative of such an approach. However, the power and influence of the middle class represent a significant barrier to the implementation of such measures and therefore developing a greater understanding of how this power may be diluted is crucial.

Another vital area of research, is the role and power of the car and associated industries in the economy, both at the level of the city and nationally. It is clear that this industrial complex makes a substantial contribution to economic activity (Paterson, 2007; Urry, 2004). The extent of this contribution needs to be quantified as well as the implications this has for restricting urban transport system change. The question that needs to be asked and answered is: If the car and its associated industries make a substantial contribution to the economy, how then, would the transition away from the car affect the economy and how could the resources currently being employed in car production be redirected to support a more sustainable transport regime; perhaps through the manufacture of rail carriages and infrastructure, bicycles, etc.

In this section I have attempted to explore both the limits of my own research as well as areas of future research which are required to enhance our understanding of transport system change and strengthen the likelihood of transition.

6.2 Conclusion

Given the deeply problematic nature of car dominated transport systems, both for local and global socio-ecological systems, it is clear that a transition towards a more ecologically and socially balanced system is necessary. Despite the power of the global "system of automobility" and its local expression in towns and cities around the world, including Stellenbosch, I have shown how it is possible to embrace a more sustainable approach. Transition in Stellenbosch will require the continued and enhanced contestation of the dominant socio-technical regime as well as the support of niche innovations already occurring there.

The importance of this research lies in the dire need to enhance our understanding of the dynamics of the transition process in order to improve the possibility that radical transition may become a reality. A deeper understanding of the process allows interested stakeholders to develop strategies and innovations which have a greater likelihood of success. A deeper understanding of the barriers to change, and specifically, the power of these barriers is absolutely crucial to the successful contestation of the dominant regime. This thesis has successfully analysed the dynamics of the Stellenbosch transport system and so contributed to the greater struggle to develop a more sustainable transport system in Stellenbosch and globally.

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Appendix A: Research interviews and interactions

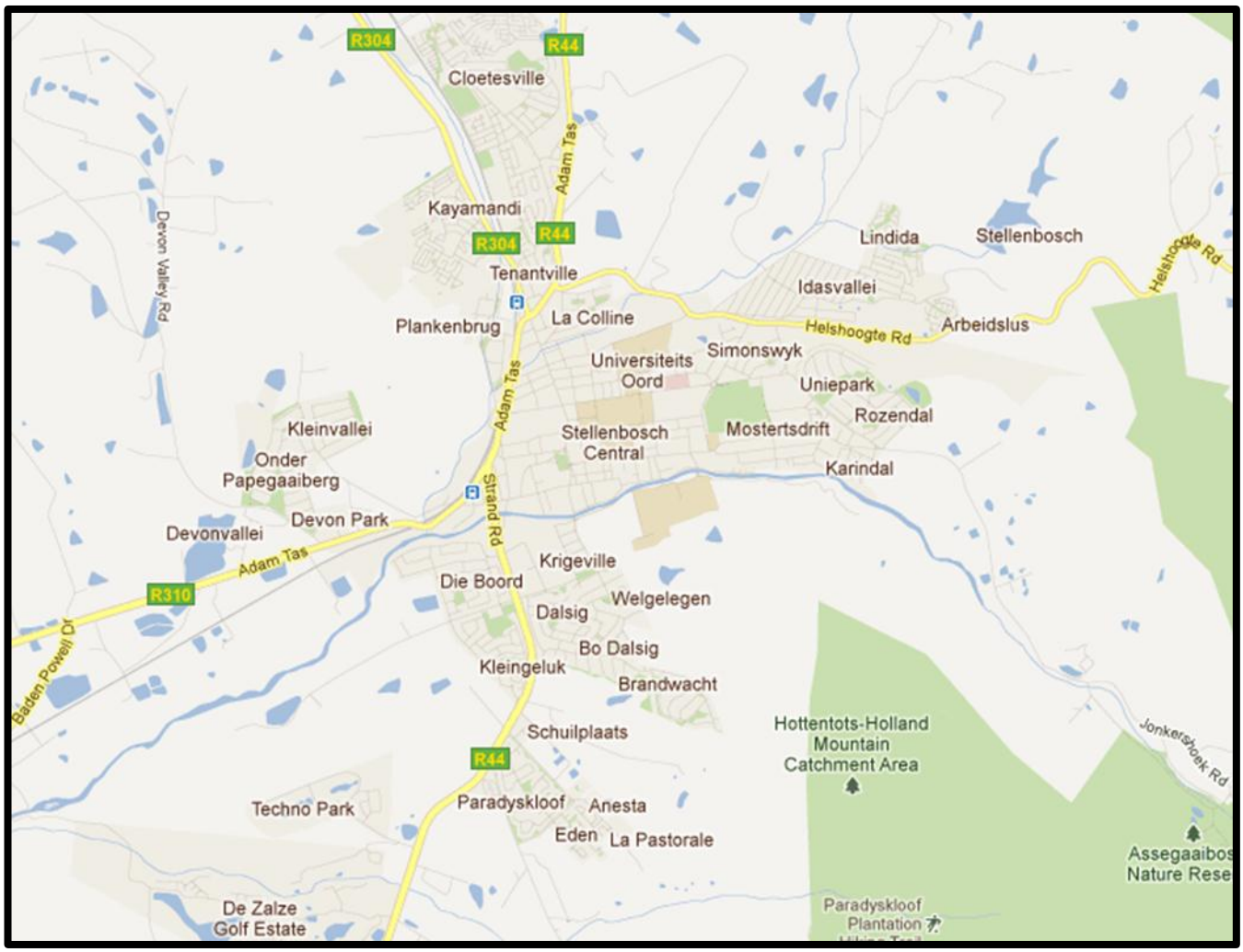
Individual	Date	Contacts	Documents
Professor Christo Bester (Civil Engineering, Stellenbosch University)	24 January 2011, 10 May 2011	None	Stellenbosch Town Transport Master Plan (ARUP) Stellenbosch Non-Motorised Transport Network Plan (SSI) Assorted final year engineering projects on transport in Stellenbosch
Barbara-Ann McEvoy Henning (Planner, Stellenbosch Municipality)	January 2011	Bernabé de la Bat Angelika van der Merwe	Stellenbosch Municipal SDF: Draft Status Quo Report (CNdV Africa) Stellenbosch Municipal SDF: Draft Strategies Report (CNdV Africa) Stellenbosch Town SDF (CNdV Africa) Stellenbosch Town Transport Master Plan (ARUP) (Digital Copy)
Chris Keyser (Part time Roads Engineer, Stellenbosch Municipality)	18 February 2011	Dawid Botha	
Angelika Van der Merwe (Manager: Transport, Roads and Stormwater, Stellenbosch Municipality)	23 February 2011	Johan Basson Professor Reyneke Schalk Opperman Melanie Venter (Newly appointed Head: Transport and Transport Planning)	Draft Stellenbosch Comprehensive Integrated Transport Plan (Vela VKE)
Bernabé de la Bat (Head : Spatial Planning, Heritage and Environment, Stellenbosch Municipality)	9 March 2011, 20 April 2011, 12 May 2011	Nigel Winter Andre Van Niekerk Piet Smit	Stellenbosch Conservation Strategy : Development Guidelines (Kruger Roos) Access to Eikestad Mall Development Documentation

Johan Basson (Technical Director, VELA VKE)	16 March 2011		
Dawid Botha (Stellenbosch Municipal Council)	17 March 2011	Carinus Lemmer Jannie Gagiano Pieter Schafma	
Carinus Lemmer (Director National Cycling Academy/NMT Liaison Committee)	24 March 2011, 25 March 2011, 18 April 2011, 26 April 2011	Richard Gordge Marita Nel	NMT Vision for Stellenbosch (Carinus Lemmer) Short term plans for improving transport in Stellenbosch (Richard Gordge)
Jannie Gagiano (Stellenbosch Municipal Council)	7 April 2011	Paolo Sandri	
Professor Reyneke (Stellenbosch Ratepayers Association/ NMT Liaison Committee)	1 April 2011		Personal thoughts on NMT Minutes of NMT Liaison Committee
Richard Gordge (Transport Consultant, Transport Futures)	4 April 2011		
Schalk Opperman (Planning and Development, SU Facilities Management)	31 March 2011		
Andre Van Niekerk (Director: Engineering Services, Stellenbosch Municipality) – short informal meeting after IDP public meeting	12 April 2011		
Gawie Groeneweld	20 April 2011	Bertha Hayes	Assorted SRA comments of developments and

(Member of Stellenbosch Ratepayers Association/NMT Liaison Committee)			Municipal policies
Marita Nel (Architect, SU Facilities Management)	18 April 2011, 11 May 2011	Ester McFarlane (Member of the Stellenbosch University Students Representative Council, Marketing and Communication)	Stellenbosch Campus Parking Study Status Quo Report (BKS) Plans of past NMT projects for SU
Piet Smit (Manager: Property Management, Stellenbosch Municipality)	20 April 2011		Tender 34 Documentation
Paolo Sandri (Owner of Wijnhuis and other properties in Church Street, Stellenbosch)	28 April 2011		Church Street documentation
Pieter Schafma (Member of the Stellenbosch Interest Group)	10 May 2011		Stellenbosch Interest Group/Stellenbosch Ratepayers Association constitutions
Johan Fullard (Head: Roads and Stormwater, Stellenbosch Municipality)	9 May 2011		
Bertha Hayes (Member of the Stellenbosch Ratepayers Association)	11 May 2011		Eikestad Mall documentation De Zalze documentation
Nigel Winter (Head: Traffic Engineering, Stellenbosch Municipality) and Hans Groenewald (Traffic Engineering, Stellenbosch Municipality)	19 May 2011		
Melanie Venter (Head: Transport and Transport Planning, Stellenbosch Municipality)	7 June 2011		

Appendix B: Maps of Stellenbosch

Map of Stellenbosch (1)



Source: Google

Map of Stellenbosch (2)